ELECTRICAL REVIEW

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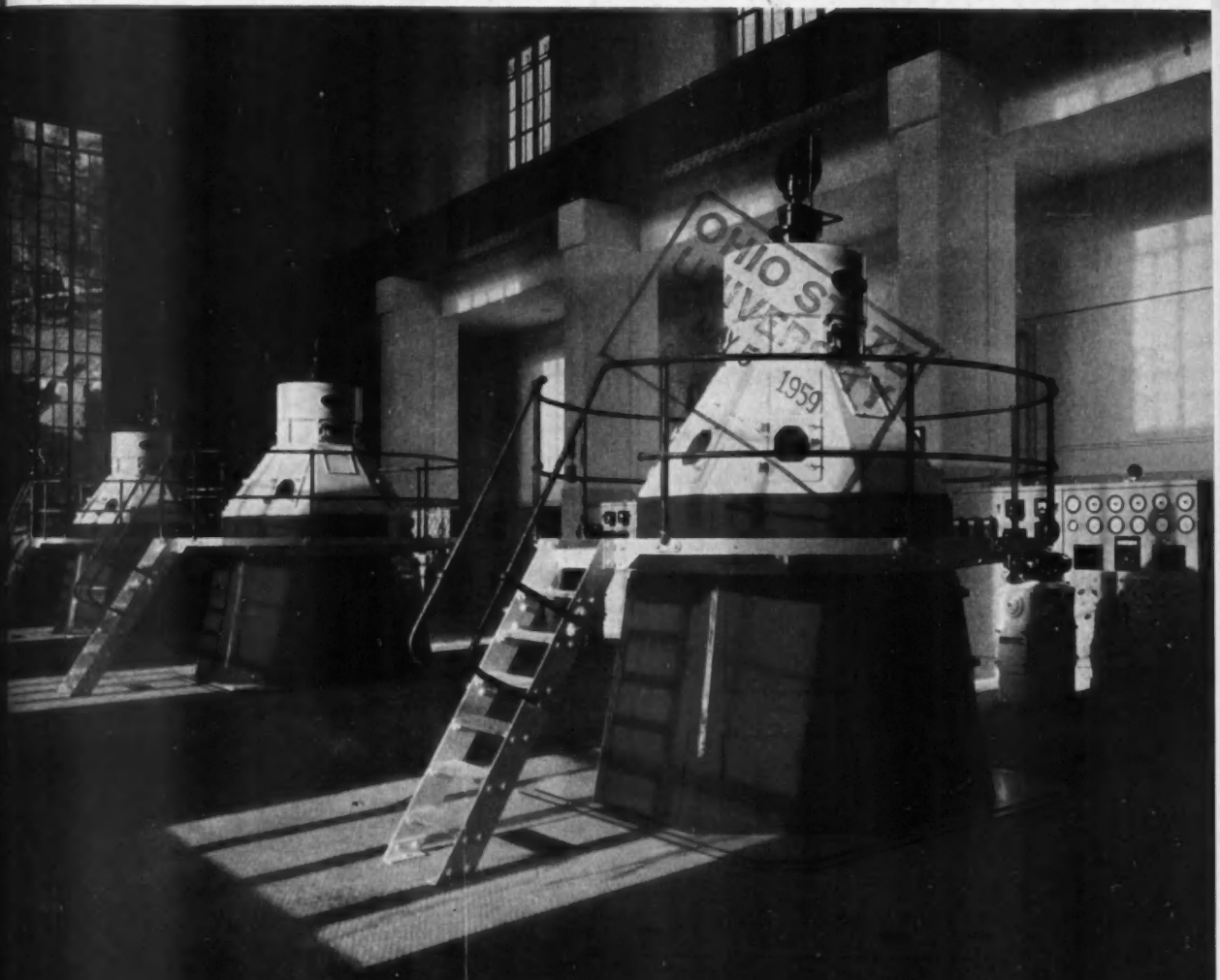

G.E.C.

The main hall of the Kennoxly Power Station of the North of Scotland Hydro-electric Board. For this station, which is designed for completely automatic operation by remote control, the G.E.C. supplied three 20 MW vertical-shaft alternators, auxiliary motors and the majority of the control gear.

power generation

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ELECTRICAL REVIEW

17 April 1959 Vol. 164 No. 16 Established 1872

Budget and Production Costs

PRESENTING his Budget proposals last week Mr. Heathcoat Amory, the Chancellor of the Exchequer, said that his aim was to help to keep the cost of living steady and lower unit costs of production by encouraging a steady but not excessive expansion in production and a continuing high rate of industrial investment. The method of procedure was to relieve the people from some of the heavy tax burden which they have borne for many years and thus leave them with more to spend.

So far as the general public is concerned the actual amount of relief as represented by lower rates of purchase tax is not large enough to have a profound effect upon the cost of living. It is rather thinly spread and it seems that the actual reduction in selling prices will not generally amount to more than 5 per cent. Nevertheless it is a reduction and therefore has a stimulating effect. Already increased sales have been reported from a number of branches of business.

Higher sales must mean greater output over which to spread overhead charges, thus achieving the Chancellor's object of reducing unit costs of production. Mr. Amory spoke of steady expansion. Steadiness is essential, for sporadic buying bursts by the public are, if anything, harmful to producers. They do not want to run their factories at an excessive pace to meet occasional peak demands and then merely allow them to " tick over " in the intervals. Thus, however much some of us would have welcomed a more drastic reduction or even removal of purchase tax, we have to admit the wisdom of taking off the brake more gradually, as the Chancellor has done. But we want the process to continue.

Greater purchasing power will be released by the reduction of 9d in the £ in income tax. This, however, should not be the main consideration in the case of manufacturing companies. It was the Chancellor's hope that tax relief would enable companies to devote more money to development and expansion. With the need for lower prices to meet growing competition in export markets manufacturers should have full regard for this point. As we said in last week's issue, expansion in home demand, although very desirable and necessary, must not proceed so far or so rapidly as to militate against

export trade. The conversion of two-thirds of the "initial allowance" upon capital expenditure into an "investment allowance" should encourage the improvement of productive plant and plant extensions when the prospect of expanded trade justifies it. This, too, should have an ultimate effect upon export prices.

INVESTMENT . . .

Capital expenditure by the electricity supply industry is this year expected to rise by £55 million to a total of £356 million. Apart from benefits to consumers this should have the welcome effect of stimulating activity in many sections of manufacturing industry. Since the money available for the reinforcement of existing systems has previously enabled the Boards to do little more than keep pace with rising demand it is particularly satisfactory to note that the amount allocated in England and Wales to this unspectacular but vital work has been increased by nearly 20 per cent. Reinforcement now accounts for over half the expenditure in this area on distribution as a whole and this is also true in the area covered by the South of Scotland Board.

Generation and the purchase of nuclear fuel in England and Wales represent three-quarters of the total increase in expenditure. Payments for the nuclear stations now under construction will reach their peak at 50 per cent above the 1958-59 level. A general speeding up of work in progress has also made it necessary to provide for payments at a higher rate than in past years on conventional stations. In fact, last year accelerated deliveries of plant and completion of civil engineering work led to an excess expenditure of £17 million.

. . . AND PLANNING

Whether the more rapid progress on present work means that the generating programmes will be restored to their original dates is not stated nor is it clear whether the spending of more money now will require adjustments to the programmes in future years. In the *Economic Survey* it was recognised that long-term projects once begun cannot be rapidly modified without inefficiency and waste. The alternate slowing down and speeding up of investment in the supply industry, in addition to its immediate and obvious disruptive effects, has serious repercussions on the manufacturers of heavy plant and their ability to export. It is therefore disappointing that, in the present easier financial conditions, the opportunity has not been taken to plan investment over a longer period than a year. In this way capital expenditure on essential work could be based on an assessment of the real needs of the community and not used as a convenient balancing item when the economy is temporarily overloaded.

FURTHER EXHIBITION REFLECTIONS

Two weeks ago we commented on the steady increase in the number of exhibitions in which members of the electrical industry participate, pointing out some of the disadvantages resulting from this increase. In the short space of time which has elapsed since our remarks were published several exhibitions have taken place and at one of these an announcement has been made which has a bearing on our earlier remarks. It is that future exhibitions organised by the Radio and Electronic Component Manufacturers' Federation will take place in alternate years and will be held at Olympia. This change has been made as a result of the electronic industries' expansion and the rising demand for stand space, but it is felt that it will result in an even more interesting display of exhibits as so many more components and items of equipment developed since the previous exhibition can be presented.

The other exhibitions held recently include the International Instruments Show, the Factory Equipment Exhibition and a display of printed circuits organised by Formica, Ltd. In at least one instance the exhibition dates were selected to coincide with the R.E.C.M.F. Exhibition, benefiting both the exhibition organisers, for a proportion of visitors to one exhibition will surely visit the others, and the visitors themselves, for the one trip to London enables them to attend two or more functions. However, our remarks concerning the difficulties of the exhibitors still apply and are indeed amplified as the problems of presenting simultaneous displays have now been introduced. Perhaps there is a case for the merging of two or more complementary shows into a single display.

MACHINE DEVELOPMENT

The aircraft industry has been developing brushless alternators for some time but it was only at the beginning of the year that the first industrial design was announced. Although the machines for aircraft and industry are of the same general type, both using rotating silicon rectifiers, they are designed for different purposes. Brushless alternators for aircraft were developed to overcome commutation difficulties at high altitudes whereas their main advantage in the industrial field is the reduction in the amount of skilled maintenance required. Among aircraft generators, brushless generators form a class by themselves but, although they use conventional excitation systems, they can be regarded as the next development following self-regulating and self-exciting machines.

An article in this issue gives an account of the development of brushless alternators for aircraft and the reason for the choice of the rotating rectifier type. The industrial machine, described in the *Electrical Review* of 20th February, has the added refinement of automatic voltage control employing transistors. This control unit is mounted inside the machine casing so that the generator is, in effect, a self-regulating, self-exciting brushless alternator.

ELECTRIC FLOOR HEATING

The series of articles on "Electric Floor Heating Practice," by Mr. R. D. Jackson, which appeared recently in the "Electrical Review," have been published in the form of a booklet. Copies, price 7s 6d each post free, can be obtained from the Publisher, "Electrical Review," Dorset House, Stamford Street, London, S.E.1

REVIEW OF THE LATEST DEVELOPMENTS IN AIRCRAFT ELECTRICS

BRUSHLESS ALTERNATORS

By A. W. FORD, B.Sc.(Eng.), A.M.I.E.E.*

In aircraft flying at altitudes of 25,000ft or more, high rates of brush wear and commutation difficulties are experienced. This has led to the recent intensive development of brushless alternators incorporating silicon rectifiers. The construction and operation of this type of alternator for aircraft applications is covered by the author, and brief mention is made of the reasons why other types of brushless alternator have not been found suitable for aircraft

AIRCRAFT electrical systems have, in the past, been supplied mainly from a d.c. source, but as the operational flying altitudes have increased brush wear has become a more serious problem. At altitudes over 25,000ft, the low atmospheric humidity can cause ordinary carbon or electro-graphitic brushes to wear away completely in a few hours. With civil aircraft flying at altitudes of 40,000ft, these brushes cannot therefore be used.

Considerable research work[1] has been carried out since the war to produce brushes which would operate satisfactorily at high altitudes. The most satisfactory brush so far produced contains a small amount of highly purified molybdenum disulphide in particle form, either dispersed uniformly throughout the carbon, or introduced as a number of small cores (of about 2 mm diameter) into the length of the brush. This type of brush is at present in extensive use in large aircraft generators in this country and in the U.S.A. and gives reasonably satisfactory service. However, all electrical machines equipped with brushes require inspection and maintenance at shorter intervals than that normally required for other components. The withdrawal and replacement of an electrical generator is a lengthy and troublesome procedure which adds to the running costs. Although the problem of brush wear at high altitudes has been partially solved by the production of new types of brushes it would seem that little further improvement can be achieved.

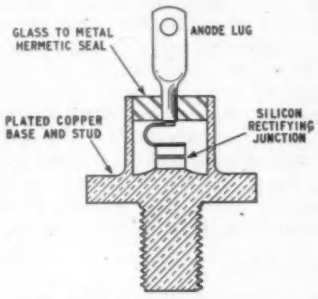


Fig. 1.—Cross-sectional view of modern silicon rectifier

The development of brushless alternators is therefore proceeding rapidly both in this country and the U.S.A. and evidence of this was to be seen at Farnborough last September. At this exhibition, a complete 40 kVA brushless alternator designed and manufactured by the English Electric Co. was shown.

All the brushless alternators for aircraft installation which have been or are being developed are of the revolving field type and the term "brushless" in this context means that the revolving field winding is energised with d.c. without the use of slip-rings or brushes. To do this requires the incorporation in the alternator of an a.c. exciter, having a revolving armature which generates the power for the alternator field, and a group of rectifiers mounted on and revolving with the shaft to convert the exciter armature output to d.c. (see Fig. 5).

The use of rectifiers in this way should not be confused with their use in conjunction with alternators now available of the self-exciting type, in which some of the alternator output is rectified and fed into the field winding through slip-rings and brushes, the rectifiers in this case being stationary.

Silicon Rectifiers

The successful development of the brushless alternator rests mainly upon the availability of the silicon rectifier. This type of rectifier possesses all the properties required for this application, which are as follows:—(a) Small physical size and weight, (b) mechanical robustness, (c) high electrical efficiency and (d) high ambient operating temperature. Germanium rectifiers would also satisfy these conditions except for their lower operating temperature.

Fig. 1 shows a typical cross-sectional view of a silicon rectifier of present-day manufacture and it can be appreciated that the two most favourable arrangements for mounting a group of rectifiers in a revolving member are either:—(a) In line inside a hollow shaft, with the axes of the rectifiers coincident with the shaft axis, thus imposing the minimum possible centrifugal force on the rectifier junction; or (b) with rectifier axes radial and equally spaced, with the junction sides of the crystals innermost at the smallest possible radius. With this arrangement, the centrifugal force on the crystal junction can be surprisingly high in an aircraft alternator, e.g. at 6,000 r.p.m. the centrifugal acceleration at 2in radius is 2,000 × g. Nevertheless, there is ample experience to show that silicon rectifiers can operate reliably under these conditions and in the presence of the vibration forces encountered in an aircraft.

Arrangement (a) may require more axial space than is available in a particular design of alternator, when due allowance is made for the space requirements of connections, etc. These considerations have led to the

* The English Electric Co., Ltd.

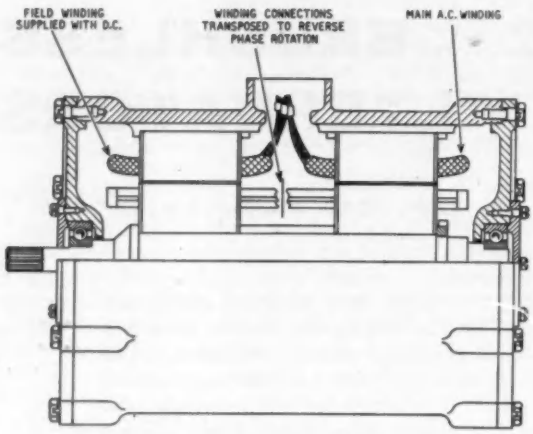


Fig. 2.—General arrangement of cascade-type generator

development of a modified mounting arrangement which will be described later.

Other methods of generating a.c. without the use of sliding contacts or rectifiers have been proposed in various literature and a short digression to survey some of the possible alternatives will illustrate the present position.

Induction Generator

It has been suggested that the use of the induction generator would eliminate quite simply all the problems associated with the use of sliding contacts in aircraft a.c. generators. However, this would introduce the following difficulties:—(a) In the absence of other generators to supply the lagging VAr required for magnetisation, both of the generator and its connected loads, a considerable weight of capacitors would be required. (b) The amount of capacitance in circuit would have to be regulated by some means, such as a saturable reactor, which would also add a considerable amount of weight. Information concerning experiments with induction generators may be found in a paper by Dr. H. M. McConnell,[2] which concludes that they are suitable for applications requiring an output up to about 1 kVA.

Inductor Alternators

The second possibility is the use of inductor alternators, in which both the field and main windings are carried on the stator, and the voltage is generated by flux variations created by the rotation of a simple toothed rotor. This type was used extensively in aircraft in the last war, but only for relatively small single-phase outputs at high frequencies. The main electrical power in aircraft today must be generated at 200 V, three-phase, 400 c/s, for which satisfactory designs of inductor alternators are not feasible. A certain amount of power at 1,600 c/s or 2,400 c/s is, however, still required in some aircraft for supplying electronic equipment, and for these applications the inductor alternator is well suited.

Cascade Generator

A simplified cross-sectional arrangement of a so-called cascade-type generator is shown in Fig. 2. This machine, which is the subject of a British patent, offers another means of dispensing with sliding contacts.

The left-hand stator core carries a distributed field winding which is energised with d.c. from a suitable source and the field so produced generates currents in a polyphase winding on the left-hand rotor. This winding is connected to a similar winding on the right-hand rotor in such a way that the fields set up by the windings in the two rotors revolve in opposite directions with respect to the rotor shaft.

The field set up by the left-hand rotor winding revolves backwards with respect to the rotor shaft so as to be stationary with respect to the left-hand stator, and so, by virtue of the cross-connection of the two rotor windings, the field set up by the windings on the right-hand rotor revolves faster than the rotor and in the same direction. If both rotors and stators are wound for the same number of poles, the field due to the right-hand rotor winding revolves twice as fast as the rotor. This field generates a.c. in the right-hand stator windings.

A machine of this type is necessarily rather large and heavy in comparison with conventional generators and does not lend itself to efficient air cooling. For these reasons it has not received favourable consideration for aircraft applications.

Stationary-Field Generator

Lastly, there are the stationary-field generators. Fig. 3 shows a novel type of generator developed and manufactured by the Aerojet Corporation of America. Synchronous machines of somewhat similar design have also been developed in the U.S.A. for aircraft applications by Jack & Heintz, Inc., of Cleveland, Ohio, under the trade name of " Secsyn " (denoting stationary exciter coil synchronous) and it is believed that other manufacturers of aircraft generators have shown interest in this type of machine. A common feature of all of them is a stationary circular field winding (or pair of windings axially opposed to avoid the creation of magnetic fluxes through the bearings) surrounding the shaft. These field windings are mounted in an annulus of magnetic material which is thus magnetised radially. The inner cylindrical face of the ring is concentric with the shaft and separated from it by a small air-gap. The outer cylindrical surface of the ring is likewise separated by a small air-gap from a ring of magnetic material which revolves with, and forms part of, the revolving field system of the generator.

The outer revolving ring of magnetic material is connected to all the pole-shoes of the same polarity, these being magnetically isolated from the shaft, which is con-

Fig. 3.—Stationary-field generator

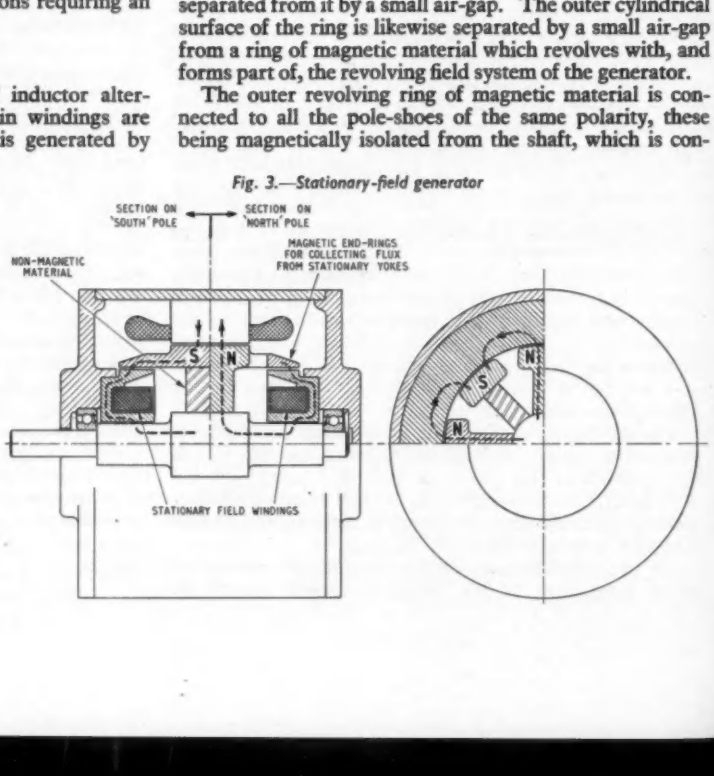
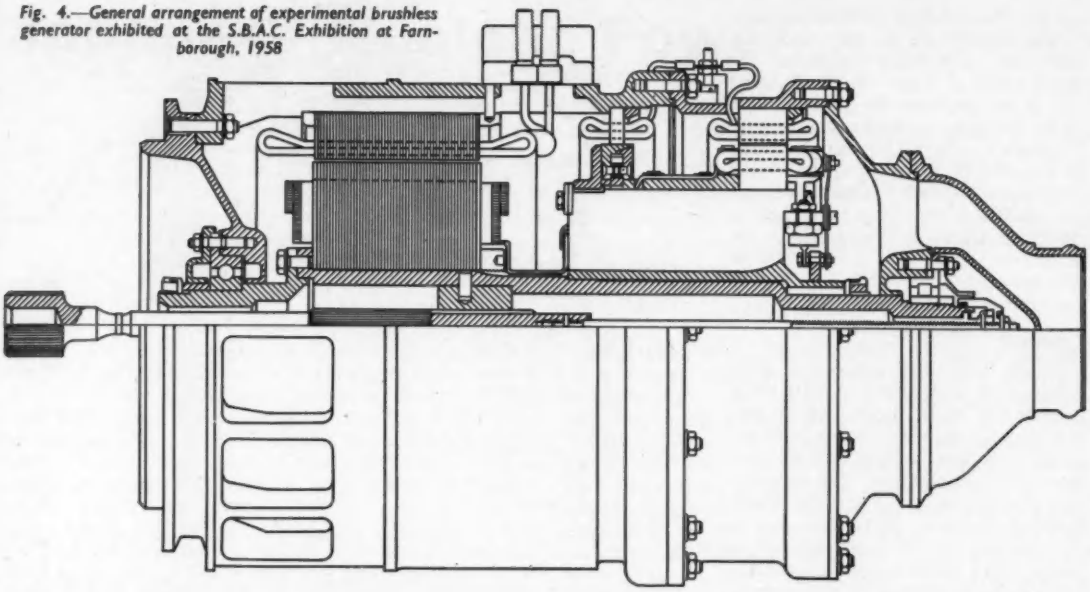


Fig. 4.—*General arrangement of experimental brushless generator exhibited at the S.B.A.C. Exhibition at Farnborough, 1958*



nected with all the poles of the opposite polarity. The complete magnetic circuit for each line of flux, including the air-gaps between the poles and the stator core, therefore includes four air-gaps.

Machines of this type have not been developed in this country in the sizes currently required for aircraft power generation, probably because effective air-cooling would be difficult to arrange. For low-power requirements, however, i.e. up to about 5 kVA, this type of machine is worthy of serious consideration and, for larger outputs, could probably be made competitive in size and weight with other types, if the windings were liquid-cooled.

Brushless Alternators

The brushless machine has none of these shortcomings and is indeed smaller than the conventional machine embodying an integral d.c. exciter. Fig. 4 is a cross-sectional view of the 40 kVA brushless generator which was shown at the S.B.A.C. Exhibition at Farnborough last September. The silicon rectifiers are mounted on a ring with their axes normal to the axis of the shaft, in an advantageous position for cooling by the incoming blast air and for the electrical connections to the a.c. exciter armature winding. The general arrangement is shown in Fig. 5.

In addition to the a.c. exciter, a permanent-magnet a.c. pilot exciter is incorporated; this provides the power for energising the exciter field.

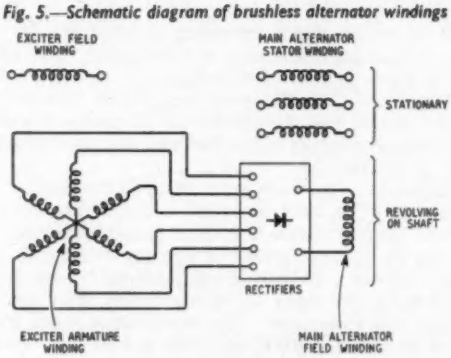
Both the main and pilot exciters are short machines of relatively large diameter, and the rotors are carried on webs joined to a hub on the shaft. The spaces between these webs allow ample space for ventilating air to flow through the machine and the aerodynamic resistance of the complete machine is remarkably low.

Nearly all aircraft generators are at present cooled by air ducted from an intake on one of the leading edges of the aircraft and discharged from the generator either into the compartment in which it is installed or through more ducting to an outlet on one of the trailing edges of the aircraft. The air pressure difference between outlet and inlet is created by the aircraft's own speed and it is not unusual for 50 per cent or more of the available pressure difference to be absorbed in the ducting. The aerodynamic resistance of the generator should therefore be made as low as possible consistent with the need to ensure that the cooling air collects heat efficiently from all the dissipating surfaces.

Exciters of short length and large diameter will preferably have a fairly large number of poles and generate at higher frequencies than the main alternator. An important advantage accruing from the increased number of poles, is that the time constant of the exciter field winding is reduced, thereby improving the speed of response of the alternator voltage to sudden load changes.

Further development of the brushless alternator has resulted in the arrangement shown in Fig. 6. The principal differences between Figs. 4 and 6 will be apparent by comparison. In Fig. 6, the permanent-magnet pilot exciter has been transferred to the drive end of the alternator. Its outside diameter has been reduced so that it can be accommodated partly inside the end-winding of the main alternator with some reduction in the total length of the machine, and without detriment to the air flow. Six silicon rectifiers are contained within the shaft, and, to minimise the axial space required, they are mounted on a flat metal strip with their axes perpendicular to the axis of the shaft, but with the centres of the silicon crystals very close to the axis of rotation. The hollow shaft is provided with openings at the drive end in order to permit cooling

Fig. 5.—*Schematic diagram of brushless alternator windings*



air for the rectifiers to flow through.

The capacity of the pilot exciter is sufficient to provide excitation for maintaining a high value of short circuit current from the alternator for fault clearing, as well as a supply (through rectifiers) for the operation of essential protective gear associated with the alternator. The power for all essential control and protection is therefore always available whilst the alternator is running, and there is no dependence upon supplies from batteries or other sources.

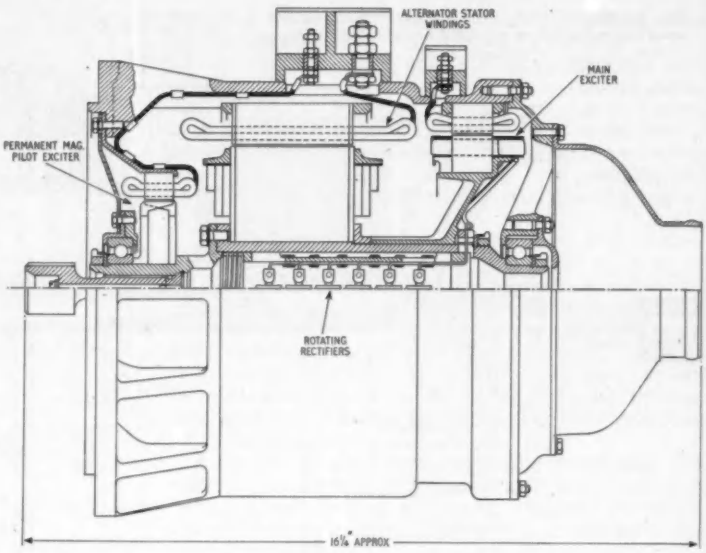


Fig. 6.—General arrangement of 40 kVA brushless generator embodying recent design modifications

Cooling

So far this brief survey has dealt with machines designed to meet those present-day requirements which permit the use of blast cooling with air taken from outside the aircraft at a reasonable temperature. The temperature of the air entering an intake duct, however, is always higher than that of the free air in which the aircraft is flying, owing to the adiabatic compression of the air caused by the forward speed of the aircraft. The temperature rise, in deg C, produced by an aircraft speed of V miles per hour, is given approximately by the formula:—

$$\text{adiabatic temp. rise (deg C)} = \left(\frac{V}{100}\right)^2$$

Thus, for an aircraft flying at 1,500 m.p.h. at 40,000ft, where the ambient air temperature averages −57 deg C, the ram air inlet temperature would be:—

$$-57 \text{ deg C} + 225 \text{ deg C} = +168 \text{ deg C}$$

As these conditions are approached, blast air cooling becomes impracticable, and it becomes necessary to consider the use of other forms of cooling. For civil aircraft, two other cooling methods appear to have almost equal merits; these are oil and refrigerant cooling. Oil coolers and refrigeration equipment are now required on the larger aircraft for other purposes and the absorption of some additional heat presents no fundamental difficulty. Unlike the brushes and commutators of conventional machines, all the components of the brushless alternator can readily be made to withstand the effects of cooling media, such as oil, and we can expect development to continue in this direction. Indeed, it may well be that much more efficient heat extraction can be achieved, with a consequent reduction in the size of the machine for a given output.

REFERENCES

[1] R. F. Sims. "The Wear of Carbon Brushes at High Altitudes." *Journal I.E.E.* 100, 1952, pp. 183-188.

[2] H. M. McConnel. "A Self-Excited Induction Generator with Regulated Voltage." American Institute of Electrical Engineers, Paper No. 54-317.

THE ELECTROGYRO LOCOMOTIVE

TESTS on an electrogyro locomotive after 15 months' operation were described recently to the Institution of Locomotive Engineers by Messrs. T. E. Green and J. K. Gessler (National Coal Board). Its cycle of operation was said to correspond closely to the haulage cycle in mines, which consisted of hauling empty cars for 15 to 20 min, shunting, and returning with full cars within 20 to 30 min. For convenience in these tests the 34 ton unit of the N.C.B. was designed for shunting duty on the surface and was the first to be equipped with two electrogyros working in parallel and was the heaviest yet built of this type.

Each electrogyro consisted of a 63·8in diameter flywheel weighing 1·56 tons and a three-phase two-pole squirrel-cage induction alternator forming one unit in an airtight casing filled with hydrogen at two-thirds atmospheric pressure. Excitation was provided by capacitances in parallel, the value of which varied with the load, voltage and frequency. The stored energy per gyro at 3,000 p.s.i. was 9 kWh, of which 6 kWh was available for operation, a total of 12 kWh being enough for nine cycles, which permitted the locomotive to work for half-an-hour between charges. The two 25 kW, 50 c/s squirrel-cage traction motors had four, six, eight and twelve poles.

Experience to date with this prototype locomotive had demonstrated its suitability to a shuttle service for haulage with a charging point at each end of the run. Fundamental changes in the design of the gyro and electrical transmission were under consideration. Regarding maintenance, the life of gyro bearings was a cardinal factor and running experience would show whether adequate working periods between renewals could be achieved. High capital cost would militate against extended use on the surface. For underground work diesel and battery units had severe limitations and the electrogyros would then compare more favourably with them. Driving costs would be the same. The gyro locomotive might be the equivalent of a battery unit relieved of the cost of battery replacement.

Japanese Nuclear Power

Further details have now become available regarding the design of the 150 MW nuclear power station which is to be built at Tokai-Mura, Japan, by the G.E.C.-Simon-Carves Atomic Energy Group for the Japan Atomic Power Company. Special arrangements are made to ensure that the plant will be safe under the most severe earthquake conditions likely to arise

IT has already been announced that the General Electric Co., Ltd., is to build Japan's first nuclear power station. In February the Japan Atomic Power Co. announced that they had opened exclusive negotiations with G.E.C. for the supply of a 150 MW nuclear power station to be built at Tokai-Mura, about 70 miles north-east of Tokyo. These negotiations have now been satisfactorily concluded and, as we stated in our last issue, a letter of intent has been placed with the G.E.C. It is expected that the final details of the £20 million contract will be settled later in the year. The station will take about four years to build and is expected to be in full operation in 1963.

For the final stages of the negotiations prior to the placing of the letter of intent, a Japanese delegation, led by Mr. Tamaki Ipponmatsu, vice-president of the Japan Atomic Power Co., arrived in this country on 24th March. The delegation also conferred with the United Kingdom Atomic Energy Authority concerning the supply of fuel for the new station and on 8th April Mr. Ipponmatsu was handed a letter of intent to supply nuclear fuel by Lord Plowden, chairman of the A.E.A. At the same time a technical assistance agreement between the Japan Atomic Power Co. and the Authority was signed between Mr. Ipponmatsu and Mr. J. B. W. Cunningham, director of industrial power, U.K.A.E.A.

Further details of the design of the single-reactor power station are now available and, as we said last week, the measures taken to ensure the safety of the installation under earthquake conditions are of particular interest.

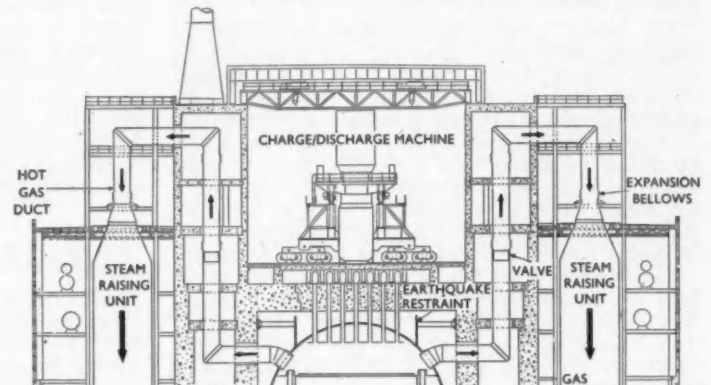
In its basic elements, the reactor is similar to those already being built for the British nuclear power programme. The natural uranium fuel elements are mounted in vertical channels through the reactor core which is built up from interlocking graphite bricks and tiles weighing a total of almost 1,500 tons. There are 2,056 fuel channels, each containing eight fuel elements. The core is completely enclosed in a 3¼in thick spherical pressure vessel having an internal diameter of 62ft, and this, in turn, is surrounded by a concrete biological shield about 10ft thick.

The heat generated inside the reactor is extracted by circulating carbon-dioxide gas through the core. This gas is heated in its passage over the fuel elements and is then led away through 6ft diameter ducts connecting the pressure vessel to four steam-raising units, two on each side of the reactor building. In these units the heat from the gas converts water into steam which is then piped to the turbine hall where it is used to drive two 85 MW turbo-generators.

Charging and discharging of fuel elements can be carried out while the reactor is on full load by means of a single machine operating above the reactor. The reactor is provided with the usual type of control system employing neutron-absorbing control rods which can be raised and lowered in vertical channels interposed between the fuel channels through the core. In addition, an independent alternative shut-down device, which can be tripped manually and which operates automatically under severe earthquake conditions, has been incorporated in the design. This device is effective even in the event of movement of the core relative to the pressure vessel. Control of the operation of the complete power station is exercised from a central control room in the reactor building.

In the design of the station a number of technical improvements have been introduced to increase the efficiency of the plant. It has been necessary to adopt a modified approach to certain fundamental aspects in view of the potential earthquake hazard in Japan, and the resulting design is fully capable of meeting the stringent

General arrangement of the reactor and heat exchanger steam-raising units for the 150 MW nuclear power station to be constructed by the G.E.C.–Simon-Carves Atomic Energy Group at Tokai-Mura, Japan



requirements laid down by the purchaser to ensure the safety of the installation under the most severe conditions which could arise from this source.

Structural Design and Plant Layout

One essential requirement in the structural design was to ensure the integrity of the reactor building and its associated steam-raising plant as a complete unit so that no breach could occur in the gas circuits. The concrete sub-structures supporting the steam-raising units are therefore carried on the main reactor foundation raft to ensure uniformity of movement during earthquakes. In addition, the support system for the gas ducts connecting the reactor pressure vessel to the steam-raising units has been so designed that the stresses in the ducts and in their junctions with the pressure vessel are maintained at safe levels in all circumstances. Furthermore, the reactor building itself houses all the plant necessary to guarantee the removal of all heat generated within the core, even if severe earthquake shocks should cause the fracture of all pipe connections between the reactor building and the turbine hall.

The reactor core, including the graphite reflector which surrounds the core proper, is a 32-sided structure. It is supported inside the pressure vessel on a steel grid of "egg-box" construction and the graphite blocks are held in place by a system of restraints in the form of a framework which encircles the whole core. This framework has been specially designed to hold the core accurately in position even during a severe earthquake.

The reactor pressure vessel is fabricated from 3¼in thick steel plates and is supported on a cylindrical steel skirt. A further skirt is welded to the vessel near the top and this is anchored to the biological shield as a precaution against disturbance during earthquakes.

Vertical standpipes connected to the top of the sphere pass upwards through the top shield, providing a means of access to the reactor core for control devices and charge/discharge equipment. Further standpipes house mechanisms capable of detecting any displacement of the core, pressure vessel or support grid due to earthquakes and of shutting down the reactor before the safety of the installation is jeopardised.

Fuel Elements

The natural uranium fuel elements are encased in magnesium alloy finned cans and each is individually supported inside its own graphite sleeve, an arrangement which was originated by the G.E.C. The weight of the stack of elements in a channel is thus transmitted through the sleeves so that stresses on the fuel rods are minimised. By making the sleeves from a specially treated graphite which has a very low permeability to the coolant gas, it has proved possible to maintain the main moderator graphite at a temperature such that no significant storage of Wigner energy occurs during the life of the reactor.

Since the fuel in this reactor is charged and discharged from above, each element is provided with a grappling device which can be gripped by the charge machine grab. This device is made of a zirconium alloy and is designed so that the cartridge itself cannot be damaged during refuelling operations.

As already indicated, the charging and discharging of fuel elements is carried out from above the reactor. By adopting such an arrangement, as opposed to the bottom charge/discharge method employed at Hunterston, the centre of gravity of the reactor building is lowered and its stability under earthquake conditions is improved.

All normal refuelling operations are carried out, while the reactor is on full load and under pressure, by a single machine travelling on a gantry above the top concrete shield. The same machine is also used for reactor servicing functions including the planned maintenance of control mechanisms. A duplicate machine is installed to provide extra facilities during start-up and to permit the withdrawal of the first machine for maintenance.

Each charge machine is remotely controlled by a single operator from a desk housed in a control room at the edge of the pile cap. To ensure the correct performance of the machine, highly developed sequence-control equipment is provided, the possibility of error being further reduced by the employment of a punched-card system for setting the requisite interlocks for any given operation. The operator can follow the working of the machine by means of mimic diagrams and closed-circuit television equipment.

For all normal reactor-control functions, including emergency trips, the usual system of control rods is employed. Each rod is suspended from a stainless steel wire rope wound on an electrically-driven drum mounted in an extension to the associated top standpipe. The driving system provides accurate control of the rod's position in the core, and of its rate of movement at all times.

In addition to the normal control rods, an alternative device, completely independent of the control-rod system, is provided to shut down the reactor in the case of an emergency, such as a severe earthquake. This system will operate even in the very remote possibility of the reactor core being greatly deranged by a violent earthquake.

Steam-Raising Units

Each of the four steam-raising units, designed by Simon-Carves, incorporates h.p. and l.p. evaporators with economiser and superheater sections. The banks of finned tubes which make up these various sections are mounted in a cylindrical pressure shell, 84ft high and with an internal diameter of 21ft 6in. The tube supports and also the skirt on which the complete unit is carried are designed to withstand earthquake shocks.

The carbon-dioxide coolant is circulated through the reactor system by single-stage centrifugal blowers. One blower is mounted in the base of the pressure shell of each of the four steam-raising units, thus avoiding the need for large separate pressure casings. Each blower is driven by a steam turbine.

In the turbine hall are two 85 MW turbo-generators, each comprising a dual-pressure steam turbine driving a hydrogen-cooled alternator incorporating direct cooling for the rotor. Apart from the normal steam condensers, dump condensing plant is provided for duty during start-up and shut-down.

Round Wire Copper Conductors

THE British Standards Institution has issued a third part to four British Standards, each differing from their respective first parts only in giving a standard range of metric sizes and in specifying all dimensions in metric units. The standards all deal with round wire copper conductors, those enamelled and cotton-covered being dealt with by B.S. 1815, Part 3, 1959, price 4s 6d; those varnish-bonded and glass-covered by B.S. 1933, Part 3, 1959, price 4s 6d; those enamelled and silk-covered or rayon-covered by B.S. 2479, Part 3, 1959, price 5s; and those silk-covered or rayon-covered by B.S. 2480, Part 3, 1959, price 5s. Copies of these new standards are obtainable from the Institution, 2, Park Street, London, W.1.

Technical Training in America

By K. R. STURLEY, B.Sc., Ph.D., M.I.E.E.*

The author recently paid a five-week visit to the United States where he studied methods of training technicians and graduates. In this article he describes what he saw, beginning by dealing with the American schooling system. He then goes on to describe the American equivalent of the technical college, of the college of technology and of the university and finally discusses broadly the industrial training of technicians and graduates

DURING the past few years our methods of training technicians and graduate engineers have been under critical examination, and comparisons have often been made with American and Russian methods which, in terms of numbers, appear to outstrip our own efforts very considerably. As far as graduate engineers are concerned, Russia produces five times and America nearly 2·5 times as many as we do per million of the population.

The author was recently given an opportunity by the B.B.C. of visiting America for five weeks to study methods of technician and graduate training. Naturally, the main interest was in broadcasting engineering but time did allow some examination of the wider field of electrical engineering and the impressions gained may be of general interest.

The basic principle of American life, that the individual shall be given the greatest possible freedom, and that government control shall be kept to the minimum, holds in education as well as in industry. Thus there is nothing like our Ministry of Education to establish a nation-wide standard, and local pressure groups do occasionally perform a serious disservice to education. Americans (often the severest critics of their own system) complain that in most high schools (the equivalent of the British secondary school) "the intellectual difficulty is avoided and little pressure is exerted to induce students to do their best." It is also claimed that "the atmosphere of many schools is inimical to intellectual progress and the bright high school students suffer from a hostile anti-intellectualism from their classmates." In fairness to the American educational system it must be pointed out that 20 million immigrants of widely differing cultures and traditions have been successfully absorbed over the past sixty years and the schools have made a major contribution in this respect. The inevitable preoccupation with social adjustment has naturally caused some loss of education, and the chief sufferers have been the brightest students whose progress has been retarded by being kept to the speed of the average. As a general rule it is agreed that the American high school student of eighteen years of age is about at the same standard as the British grammar schoolboy of sixteen years of age, i.e. he is at about the "O" level of the General Certificate of Education. An acute shortage of first-class teachers of science and mathematics exists and there is even less encouragement to recruitment than in Britain because the teaching profession is not held in very high esteem.

The contrast in treatment accorded to the American boy or girl before and after leaving school is staggering. Most are thrown in at the deep end and are expected to fend for themselves so that earning while learning is commonplace. It is estimated that almost as many are studying for degrees on a part-time evening basis as on a full-time basis. Scholarships and loans are available but seldom cover more than fees, and maintenance grants are rare.

Technical Education

University degrees are highly regarded in America, and there is a tendency for the junior or community college (somewhat similar in character to a combination of our commercial college and technical college) to concentrate on a two-year pre-university full-time course, after which the student leaves to join the third year of a university course. The chief merit of the scheme is that the cost is much reduced to the student for he can often live at home; if the college is State-controlled the student pays only about one-third of the tuition fees, the other two-thirds being met by the local State. Many Americans would prefer to see the community college concentrating its effort on a two-year full-time technicians' course, and more colleges are turning to this. The standard reached in electrical engineering in some of the technician courses examined by the author seemed to correspond to about A1 level of the Higher National Certificate; one-third of the total time of the course is devoted to general education (English, history, social sciences), one-third to workshop and draughting practice and another one-third to the science applicable to the specialist activity, electrical, aeronautical, dental technology, etc. Each college insists on the right to manage its own affairs and set its standards, but there are generally local advisory committees. Nation-wide examinations like those organised in Britain by the City and Guilds of London Institute and the assessed National Certificate courses are unknown. The Engineers' Council for Professional Development (E.C.P.D.), a body drawn from the professional institutions representing all kinds of engineers, is beginning to establish a minimum standard through a system of "accreditation" of courses as they have done for university-type courses. Many community colleges also undertake short courses for re-training or re-grading staff in local industry.

Besides these colleges there are the technical institutes, which tend to specialise in narrow fields. They may be privately or publicly operated and their courses generally last for slightly more than two years on a full-time basis. As a rule, there is a part-time evening course alternative. The standard reached in a narrow field may be quite high and two such institutes provide a large proportion of the recruits to sound and television broadcasting.

Correspondence courses are much more widely used

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in America than in Britain and the standard of presentation and production in the engineering field is good. The cost is high, generally of the order of three times (at three dollars to the £) that of an equivalent course from a British correspondence school.

Undergraduate Engineering Education

Much of the undergraduate education is carried out in Institutes of Technology (roughly equivalent to our Colleges of Technology), most of which seem to be privately supported. The universities may be privately or State controlled; the latter must accept any who apply from the particular State in which they are situated, but they can be rejected if they fail at the end of the first year. One State university with an engineering school terminated three-quarters of its first-year engineering recruits in 1956. Only a few of the privately organised universities are well endowed and a good deal of effort has to be expended in finding the money needed beyond that provided by fees. The better universities and institutes of technology have standards comparable with our own but there is considerable variation; privately organised institutes occur at both ends of the scale with the State universities in the middle. This variability of standard appears to be due to three factors—no external examiners or assessors are used, complete autonomy is insisted upon and the professional institutes do not themselves run qualifying examinations. E.C.P.D. are bringing some uniformity through a system of accreditation of engineering courses. It is interesting to note that, for America as a whole, of those who start an engineering career less than half finally achieve a degree. The high rate of attrition is ascribed to the propaganda for and glamorising of engineering as a career, but it could also be due to inadequate teaching of mathematics and science in the high schools. The number of years of science teaching appears to have a significant effect on whether a high school student will successfully specialise in science or engineering; thus the Engineering and Scientific Manpower Newsletter (25th October, 1957) quotes a 1:4:8 ratio of science/engineering graduates out of high school students who have received one, two and three years respectively of science teaching. It should be noted that some benefit accrues to American industry from the failed university students, many of whom join the ranks of the technicians. The number of enrolments for engineering courses amounts to about 10 per cent of the total undergraduate population, and engineering graduates are about 9 per cent of the total. Entrance requirements vary considerably, but all students must have attended high school and are personally interviewed by the admissions department which serves the whole university or institute of technology. The better quality institutions will consider only the top third of high school output and apply a weighting procedure according to the known educational standard of the high school. Sometimes an entrance examination must be taken or the College Entrance Board examination is used. This Board is a non-profit-making organisation of educational institutions and foundations, and the examination itself includes papers in advanced mathematics, English composition, and physics or chemistry as well as a scholastic aptitude test. Most engineering colleges stipulate that English, mathematics (including algebra, trigonometry and geometry) and science shall have been taken at high school.

The four-year undergraduate engineering course consists of two terms (semesters) of 15-18 weeks each per year with fees varying from 300 to 600 dollars per term. The first year is common to all branches of engineering and includes chemistry, physics, mathematics, engineering drawing, physical education and the humanities (English literature, history and economics) which are studied throughout the undergraduate period. For electrical engineers the second-year subjects are physics, mathematics, applied mechanics, and elementary electrical theory. Mathematics, strength of materials, thermodynamics, and more advanced electrical theory including electronics appear in the third year. A choice between a power or electronics course is made in the final year, when a project selected from an official list is undertaken and a thesis written. Attendance for laboratory work and for a proportion of the lectures is compulsory. In the laboratory students work in groups of two or three with about one instructor to every five groups. The instructor is usually a junior member of the teaching staff working for a higher degree and is more akin to our demonstrator. In some institutions the student is expected to predict the experimental result before undertaking the laboratory work, which is merely confirmatory. Only about one fully-written report is expected per term, the other experiments being recorded in outline only.

The keynote of the American university course is instruction as opposed to learning by the student himself and "quizzes" are a regular means of checking his progress. Failure in the terminal examinations means that a subject must be repeated and if a number of subjects are affected the year must be repeated. Termination may result from continued failure.

Owing to the poor educational level reached by the high school, the four-year course for the degree of Bachelor of Science (B.S.) has to start at a low level and it is generally agreed that the average American B.S. is about equivalent to a pass degree in Britain. Aims seem to vary with the institution, but three definite trends can be seen and the "end product" may be a design engineer with a knowledge of techniques, a development engineer with an understanding of the electrical properties of materials or an engineer with a good background of mathematics and physics, in fact an engineering physicist. Instruction is carried through to the higher degrees and the M.S. year contains a good deal of instruction and little or no research. Advanced instruction and research is a feature of the Ph.D. degree which in the better institutions is a very good quality award. The co-operative undergraduate course (not a new idea) whereby a student spends part of his time in industry is growing in popularity. It bears some resemblance to our sandwich course and generally lasts five years. The industrial period is interleaved with the college periods in the approximate ratio of one to two, and a total of about a year in industry is achieved.

Technician Training in Industry

There appear to be few schemes for training technicians in industry to compare with those available in Britain. Specialised training seemed to be provided for trouble-shooters and inspectors but most technicians were expected to learn on the job. One company manufacturing a complicated form of very large computer installation was conducting an excellent training programme for maintenance technicians. It started with a revision of the fundamental principles underlying the apparatus and then proceeded to specialist training in maintenance techniques. There was no delay between the end of the course and the starting of work on an actual installation. Overtraining was avoided because provision was made for more advanced technical training to be given later to those who were to be promoted and presented with wider responsibilities.

American industry appeared to be more conscious than

British industry of the need to give management training to all types of staff, including technician supervisors.

Graduate Training in Industry

There is little difference between American and British practice in providing training in industry for the graduate. The two-year course contains an induction period, rotational assignments and post-graduate study, but considerable emphasis is placed on obtaining a further degree and close links are made between the universities and industrial training departments in order to facilitate this. Basic workshop training does not feature in the course, because, as one executive said to the author, " We pay for the brains of the engineer not his hands."

A glance at the advertisement columns of our own newspapers will show that certain types of electrical engineering graduates are still in short supply in America, but some American industrialists expressed the view that " stockpiling " had occurred and a prolonged slump would see a large number of graduate engineers appearing on the market. Some professors felt that graduate engineers were not being properly used and that many were employed on what were really technician duties.

General Observations

There are a number of features in American industrial society that are of interest to the British engineer. The habit of using Christian names between chief and subordinate creates an informal atmosphere which appears to improve communication without undermining authority. A close study has been made of human relationships in industry and the results have been of value in improving staff morale and hence staff output, but it also seems to have led to an attempt at assessing people in machine-like terms and to an obsession concerning " what the boss thinks of me." The spirit of enterprise is very marked and gives a buoyancy which encourages the American to tackle the impossible. There is less tendency than there was for movement to take place from company to company, and trade unionism with its stress on seniority and the non-contributory pension are partly responsible for this state of affairs.

Corporate membership of a professional institution is easier to achieve in America than in Britain, and a graduate who has taken an E.C.P.D. accredited course can join that class as soon as he has graduated. One institution admits technicians to its corporate membership if they have completed a two-year full-time technicians' course and a year's responsible practical experience. On the other hand, engineers whose work may have direct bearing on the safety of the public must be State-registered. The standard required varies from State to State, but an applicant for registration generally must have completed five years of practical experience after graduation and have taken a written examination involving a total time of about sixteen hours.

Summarising, it can be said that there is much to be learnt from a study of America's achievements in the field of technical education and training, and their free and easy manner of communication, attitude to the " impossible," insistence on self-help and urge to find something new are features of considerable significance to us.

BOILER REFRACTORIES

TESTS carried out on nine modern oil-fired marine water-tube boilers of from 36 to 67 klb/hr to determine the refractory heat face temperatures were described in a paper presented on 14th April before the Institute of Marine Engineers by Messrs. W. McClimont (British Shipbuilding Research Association), H. M. Richardson (British Ceramic Research Association) and B. Taylor (Charles D. Holmes & Co., formerly with B.S.R.A.).

By far the commonest cause of wastage of brickwork was stated to be fluctuations in operating temperature, which caused spalling and cracking, possibly influenced by slagging. Design and operation of oil-burning equipment as affecting combustion efficiency had a marked effect on brickwork temperature. Steady temperatures were likely to vary between limits obtained with short-flame burning and flame impingement; on exposed walls this range might be 500 deg F.

Rates of heating and cooling were found to vary widely between boilers. The most severe conditions occurred in the burner quarl blocks, where temperatures of about 2,550 deg F could be reached. The rate of change could exceed that which caused normal firebricks to crack in laboratory tests and was too rapid to follow with manually operated equipment. Platinum/platinum-rhodium thermocouples were therefore used in conjunction with a six-channel automatic recorder of the galvanometer type working at four-minute intervals.

The previous practice of lining combustion chambers throughout with the same class of material had generally given way to the use of high-grade material only where necessary and less expensive material elsewhere. The spalling resistance of moulded materials had greatly increased the life of plant walls and reduced the cost and time of maintenance. The introduction of precast quarls had also expedited maintenance. Other recent developments included an increasing use of monolithic construction, elimination of low wide walls, the welding of brick supporting keys to casings and the use of higher alumina bricks.

Nuclear Electricity

LAST week an announcement was made by Professor R. W. Pidd, University of Michigan, that means had been discovered of producing electricity directly from nuclear power, eliminating the use of boilers, turbines, etc. He said that the method had already been tested at the Los Alamos laboratories of the Atomic Energy Commission which are operated by the University of California.

In the Los Alamos experiments electricity was produced with a uranium carbide source surrounded by plasma or electrified gas made from caesium. The Los Alamos laboratories stated that a plasma thermocouple had produced enough power to illuminate a lamp for 12 hours before the apparatus was dismantled for examination. It was explained that the plasma thermocouple resembled a small fruit juice tin. A rod of enriched uranium $\frac{3}{4}$in long and $\frac{1}{4}$in in diameter was suspended in the centre of the can and surrounded by caesium gas. When this assembly was lowered into the core of a heterogeneous reactor the neutron flux caused fission to take place in the uranium with the result that the centre of the can heated up. The exterior of the can was cooled to lower the temperature of the caesium plasma.

INCREASED CAPITAL INVESTMENT

Total of £356 Million Approved for Electricity Supply in 1959-60

AN increase of £70 million in capital expenditure on fixed assets by the coal, gas and electricity industries has been approved for the year 1959-60. Of this increase £46 million is for electricity supply, all but £700,000 being allocated to the Electricity Council and the Boards in England and Wales. In addition, expenditure of £8·9 million on nuclear fuel has been approved.

Estimates of capital investment in the public sector were included for the first time this year in the "Economic Survey" (*Electrical Review*, 10th April) and the figures are now confirmed, with slight changes, in the annual White Paper "Capital Investment in the Coal, Electricity and Gas Industries" (H.M. Stationery Office, price 6d).

A summary of the expenditure incurred and proposed is shown in Table 1. At the end of 1958 authority was given for additional expenditure to be incurred during the period ending March, 1960, on capital works of a short-term character which could be brought forward. This expenditure is included in the totals in Table 1 and for the Electricity Council and the Boards it amounts to £2·3 million up to 31st March, 1959, and £8·7 million in the subsequent twelve months. The increases of £0·3 million and £0·8 million approved respectively for the North of Scotland Hydro-Electric Board and South of Scotland Board are wholly allocated to the calendar year 1959.

The figure finally approved for capital expenditure by the electricity supply industry in England and Wales in 1958-59 was therefore £241·3 million. Actual expenditure was £258·5 million and the White Paper states that the Minister is satisfied that the excess of £17·2 million was mainly due to the easier supply situation which accelerated both the delivery of plant and the completion of civil engineering work. An analysis of last year's expenditure and of the programme for 1959-60 is given in Table 2.

Expenditure in England and Wales during 1958-59 included progress payments on the nuclear power stations at Berkeley, Bradwell and Hinkley Point and the cost of preliminary works at Trawsfynydd. Expenditure on distribution included the cost of connecting 327,000 new consumers and a further 11,200 farms in the twelve months ended 31st December, 1958. Because of the speeding up of work in progress on conventional stations expenditure approved for 1959-60 includes provision for payments at a higher rate than in past years. Payments in respect of the nuclear stations now under construction will reach their peak during the year, and provision is also made for much-needed extension and reinforcement of the transmission and distribution systems.

TABLE 1.—CAPITAL EXPENDITURE ON FIXED ASSETS, £ MILLION

Board	1957 Expenditure	1958 Approved	1958 Expenditure	1959 Approved
National Coal Board ...	102·8	100·0	104·2§	122·0
Electricity Council and Boards*	240·2	241·3	258·5‡	303·5
North of Scotland Hydro-Electric Board	16·9	17·1	15·4	15·4
South of Scotland Electricity Board	19·2	26·5	27·6	28·3
Gas Council and Boards* ...	55·6	54·0	48·8‡	55·5
Total	434·7	438·9	454·5	524·7

* Year commencing 1st April. § 53 weeks. ‡ Estimate.

TABLE 2.—ELECTRICITY (COUNCIL AND BOARDS) £ MILLION

Purpose	Estimated, 1958-59	Programme, 1959-60
Generation:		
Conventional stations	106·5	117·5
Nuclear stations	38·0	57·0
Main transmission	31·3	34·0
Distribution	82·7	95·0
Nuclear fuel	—	8·9
Total	258·5	312·4
Distribution (included above):		
Rural development	6·1	6·7
Other new connections	29·8	31·1
Reinforcement of existing systems	39·3	46·3
Workshops, depots, stores, garages, offices, etc.	2·6	4·6
Other expenditure including standardisation	4·9	6·3
Total	82·7	95·0

Scottish Boards

Capital expenditure by the North of Scotland Hydro-Electric Board in 1958 amounted to £15·4 million out of an approved programme of £17·1 million. Additional generating capacity totalling 84 MW was commissioned and work started on the Strathfarrar scheme. Approximately 10,000 consumers, including 1,200 farms and crofts, were given supplies for the first time. Expenditure for this year is mainly for hydro-electric schemes at present in hand but includes provision for schemes authorised or being promoted. The additional generating capacity and transmission and distribution facilities are needed to meet the growing demand in the Board's own area and to maintain deliveries of peak supplies to the South of Scotland.

TABLE 3.—SCOTTISH ELECTRICITY BOARDS, £ MILLION

Purpose	South of Scotland 1958	South of Scotland 1959	North of Scotland 1958	North of Scotland 1959
Generation	17·6	16·2	11·5	10·0
Transmission	2·4	3·5	1·4	2·2
Distribution	7·1	7·7	2·5	3·1
Other	0·5	0·9	—	0·1
Total	27·6	28·3	15·4	15·4

The South of Scotland Electricity Board was given approval for capital expenditure of £26·5 million in 1958; actual expenditure was £27·6 million. Completion of the first stage of Kincardine power station brought into commission generating plant with an installed capacity of 120 MW, and the connection of a further 950 farms means that 88 per cent of the farms in the Board's area are now receiving supplies. The proposed expenditure on generating plant in 1959 is almost wholly accounted for by the nuclear station at Hunterston and the coal-fired station at Kincardine. The Board is hoping to connect some 22,750 houses in 1959 and its rural development scheme is expected to be completed by the end of the year. About £4·5 million of the estimated expenditure on distribution will be spent on reinforcement.

VIEWS on the NEWS

By REFLECTOR

THE recent discussion at the I.E.E. on the subject of women in engineering, based on the report of a committee set up by the Manchester College of Science and Technology, produced some interesting observations. I am left with a feeling of some thankfulness that the opportunities for training women are not being taken up and that therefore the understaffed and congested training facilities can continue to be available mostly to men. What justification can there be for training a lot of women in engineering, when, as one speaker at the I.E.E. observed, the average length of service of the professional woman is only 2¾ years? The trained woman would be little more than an apprentice for some part of this time, yet the cost of her training in time and money will have been considerable. If the average service is now 2¾ years it may well be that this figure will fall into step with the levelling up of males and females numerically, a tendency which promises that in a few years the matrimonial wallflower may disappear. Dr. K. R. Sturley remarked that "the universities, schools and parents must share the blame for not encouraging women to enter electrical engineering." If he had said "share the credit" I should have been more in agreement with him.

* * *

When an organisation with which one has been dealing for many years changes its telephone number it is often difficult to get used to the new number, and also to provide oneself with some sort of memory tag which will enable one to recall the number readily. This difficulty does not arise however in the case of the Institution of Electrical Engineers which has just changed its telephone number to Covent Garden 1871. This will be a much easier number to remember than the old one since, coincidentally, 1871 is the year in which the Institution was originally founded as the Society of Telegraph Engineers.

* * *

The *Daily Mail* reports that Baron Ravensworth has cut the cost of installing electricity in the homes of his estate workers by doing the job himself. How much more fortunate is his Lordship than Hilaire Belloc's celebrated Lord Finchley who

> ". . . . tried to mend the electric light Himself. It killed him and it served him right. It is the duty of the wealthy man to give employment to the artisan."

But then Lord Ravensworth is at any rate a radio engineer.

* * *

Why a dog's life is still considered to be the nadir of misery passes my comprehension. All around I see examples of the pampering of our canine friends. Some of them have even been provided with electric floor warming. The Eastern Electricity Board has just completed an installation at an establishment in Mill Hill, London, at which there are eighteen kennels. The Board says that the system is primarily for the benefit of "surgical dogs" who, I presume, are sick, not operating, animals.

* * *

Regional Power, the magazine of the Eastern, London and South Eastern Region of the Central Electricity Generating Board, reports that executive members of the South Eastern Division who will be taking part in engineering discussions with French engineers on the cross-Channel cable link have been brushing up their knowledge of the French language. The report is headed "Ou est les Kilowatts de ma tante?"

* * *

In an attempt to revive interest in the electric passenger car the Syracuse University in the United States recently ran a competition. The *Electrical World* quotes the head of the University's Industrial Design Department as saying that there was a market in the United States for the electric runabout "as a second car for local suburban use." Entrants to the competition produced designs for cars capable of speeds between 35 and 60 m.p.h. and ranges of from 50 to 80 miles. It was stipulated that the car should not cost more than $2,500 plus $150 for an automatic recharger and the annual running cost was set at $163, including $50 for recharging. The *Electrical World* illustrates the winning designs which are on very modern lines and capable, it is claimed, of accommodating two adults and two children. I would like to think that a resuscitation of the electric runabout was a possibility but in the absence of a widespread battery-changing system it does not seem likely.

* * *

It seems as though proposals to use electricity for domestic heating actually pre-dated the electric fire or radiator. Among the patent specifications mentioned in the *Electrical Review* of 19th April, 1889, was one for "Improvements in electrically heating rooms, buildings and the like" by J. V. Capek. The invention was said to be for:—

> "1. Electrically heating rooms, buildings, and the like, by means of thin widely-spread electrical conducting bodies, such as adherent coatings of carbons applied to non-electrical conducting surfaces and placed upon the walls of a room or in other convenient situations, the electric current being passed through the whole coating with uniformity, and the resistance and radiating surface of the coating being so proportioned to the current that such coating is heated at every part to a uniform temperature. . . . 2. Electrically heating rooms, buildings, and the like, by means of strips or pieces of combustible materials such as wood or paper, covered with coatings of electrical conducting material, through which the electric current is passed. . . ."

NEW BOOKS

The Theory and Design of Magnetic Amplifiers. By E. H. Frost-Smith. Pp. 487; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 75s.

This work is one of a series on automation and control engineering. It is stated that it is the aim of the book to give an account of the theory of magnetic amplifiers and to link theory with design. Following a brief review of a.c. theory and ferro-magnetism, including a discussion of various forms of magnetisation curves, measuring techniques are considered. These are important in magnetic amplifier work where the waveform of alternating currents is far from sinusoidal. A summary of the material covered in the book is given in the second chapter. This includes full-wave and fast half-wave magnetic amplifiers and second harmonic modulators, with discussions of relative power gains. Some properties of four core materials are tabulated.

Transient operation of magnetic amplifiers is considered and details of various magnetic amplifier circuits are discussed. Chapter 4 deals with self-excited high gain magnetic amplifiers. Analogies to feedback amplifiers are presented, non-linearity is discussed and expressions for gain and power output are developed, while auto-excitation and the effect of bias are mentioned. Analysis is carried out in terms of square wave as well as sine wave excitation, the former leading to simpler and more readily understood arguments.

Chapter 7 is devoted to a brief survey of closed loop control systems and chapter eight deals with transient response of magnetic amplifiers. Useful discussions of the effects of load circuit smoothing are included, and the difference between the time constants for increasing and decreasing control signals is examined. The subject of half-wave magnetic amplifiers is next considered. Ramey and other circuits are described and various balanced magnetic amplifier circuits are shown. In a chapter on even harmonic modulators, figures of zero drift have been collected. Chapter 13 contains general design data. Design examples are presented, such as a magnetic amplifier for a position control system, and transistor control and battery charging are mentioned. The work is supplemented by photographs of a number of magnetic amplifier devices, and a bibliography of 57 references is included.—G.M.E.

Electric Machinery. By Clifford C. Carr. Pp. 537; figs. Published by John Wiley & Sons, Inc. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 74s.

It is regrettably becoming uncommon to find heads of departments in teaching establishments who have electrical rotating machinery as their primary interest, and it is encouraging to find that the author of this entirely new book about the principles of rotating machinery and transformers is head of the electrical engineering department of the Pratt Institute in Brooklyn, New York. The book deals with both a.c. and d.c. machines using a standard notation and liberal use of vector diagrams. It aims essentially at the fundamentals and deals with them at great length, starting from very elementary ideas, and it does not claim to describe the many variations of basic machines which tend to crowd similar textbooks. In particular, the approach to magnetic circuits and the m.m.f. diagrams of field and armature conductors is well done. This leads in the induction motor section to an easy development of the theory and a clear understanding of the equivalent passive network circuits.

The analysis throughout is elementary and based mainly on vector diagrams. There is no attempt to deal with transient operating conditions and the book is lacking in this respect. It will not on its own be a suitable book for a student reading for a degree, for it also does not deal adequately with commutation, winding techniques, or variable-speed type induction motors. Each chapter is completed by the inclusion of a large number of examples, many of them numerical, but it would probably have been more helpful to the independent student if answers could have been supplied. There are no references to original sources or more advanced work. Apart from these criticisms the book is well produced, with excellent line drawings and photographs.—J.C.W.

BOOKS RECEIVED

Progress in Dielectrics. Vol. I. Edited by J. B. Birks and J. H. Schulman. Pp. 312; figs. 139. Heywood & Co., Ltd., Carlton House, Great Queen Street, London, W.C.2. Price 70s.

Electricity and Magnetism. 3rd Edition. By A. W. Hirst. Pp. 438; figs. Blackie & Son, Ltd., 17, Stanhope Street, Glasgow, C.4. Price 40s. In this edition the M.K.S. system of units has been used and the contents revised.

Electric Lamps. Revised reprint. Pp. 153; figs. Prepared by the British Lighting Council, Ltd., Brettenham House, 16-18, Lancaster Place, W.C.2. Price 10s 6d.

Aircraft Electrical Engineering. Pp. 349; figs. Edited by G. G. Wakefield. Chapman & Hall, Ltd. Price 50s.

I.E.E. Special Meeting

A SPECIAL general meeting of corporate members of the Institution of Electrical Engineers was held on 9th April, when changes in the by-laws proposed by the Council were considered. An amendment that the changes proposed to by-law 26—entrance fees, and by-law 27—annual subscriptions, be deleted was adopted by a small majority. In the discussion, many speakers requested fuller details of the financial background, and sufficient opportunity for these to be considered before a final decision on the proposed increases was reached.

In his replies, the President, Mr. S. E. Goodall, undertook that when proposals for increases in the entrance fees and annual subscriptions were submitted to a further special general meeting, supporting financial and other details, reference to which had been made in the discussion, would be circulated to members with the notice convening the meeting.

Amendments were adopted making textual changes representing drafting improvements in by-law 12, which sets out the requirements for associate membership. In the revised by-law 12, dealing with the requirements for graduate membership the words " and that the work upon which he is engaged is conducive to this end " are to be deleted from sub-paragraph (b). Subject to these amendments, the changes proposed were adopted unanimously.

The meeting was attended by less than 100 corporate members, and the President stated that 178 valid proxies had been received.

PARLIAMENTARY REPORT

Points from the Budget Debate

Members of all parties welcomed the Government's decision to reduce taxation and to restore investment allowances on new plant and machinery when the Budget was debated last week. Many with business connections praised the decision to couple the 20 per cent allowance on new plant and machinery and 10 per cent on new industrial building with a 10 per cent and 5 per cent initial allowance, respectively. These two allowances take the place of the former initial allowances of 30 per cent on plant and machinery and 15 per cent on industrial buildings.

Mr. Gaitskell regretted that the Chancellor had not decided to give this expansionist stimulus six or even twelve months ago as the Opposition had recommended. In the first half of last year, he said, there was far less danger of expansion involving the country in a balance of payments crisis than there was now.

Mr. Ellis Smith, commenting on the reference in the "Economic Survey" to the fact that between 40 and 50 per cent of the engineering industry's products were exported, said that these exports were being subsidised at the expense of highly skilled engineers. The wages of engineers were nowhere near what they should be, in comparison with the wages paid in America. He asked the Government to note the advice given in the Export Guide of the General Electric Co. calling attention to the colossal size of the potential market in China.

Mr. Eric Johnson thought British manufacturers were only scratching at the surface of the enormous market potential in Canada. There were no restrictions, no quotas, and Canada wanted British goods.

Mr. Harold Wilson welcomed the decision to support expansion yet saw a balance of payments crisis ahead if the Government concentrated too much on consumption rather than investment. If they did this the pull of the home market would be greater and that would hold back exports and increase imports.

Referring to the investment allowances, Mr. Grimond said that all this chopping and changing about was a bad thing. These allowances should be a permanent part of our financial structure.

Sir David Eccles, President of the Board of Trade, said that during the "credit squeeze" industries were under great pressure to increase efficiency and many industrialists had told him that they were now able to get more out of their plant than they ever thought possible when rising prices put a premium on sheer output. This was one reason for the rather exceptional fall in orders for plant and machinery last year. It had been a difficult year in the export field, but with home demand restrained manufacturers had spent more time exploring the export markets. Unfortunately, the pressure of certain interests in the United States to keep out foreign competition had done damage to a number of British export trades. When one considered the immense purchasing power of the Americans and their unrivalled record as manufacturers, it was reasonable to expect them to turn their backs on protectionism. What they did would influence very much the commercial policies of the rest of the world. For our part, we should like to see a fresh and combined effort by all countries of the free world to open their markets more generously to each other.

The Government had just come to an agreement with the French which would give some British industries better opportunities to sell in France. He foresaw a growing specialisation in the export of manufactured goods and he saw no reason why French and British industry should not do equally well in the markets of the free world.

He reported that arrangements were being made for a trade mission to Russia, though its scope had not been decided. One development was that the Russians had greatly increased their inquiries in Britain for capital goods—indeed for whole factories—and the manufacturers were asking the Export Credits Guarantee Department if the sums involved could be insured. How far we could go in that direction had to be considered very carefully. The orders were there; the problem was finance.

Apprentice Training

Asked what was being done to implement the Carr Committee's recommendations on apprentice training, Mr. Wood, Parliamentary Secretary, Ministry of Labour, said that these were addressed to industry, and industry must be responsible for carrying them out.

Mr. King said there had been a series of excellent generalisations on this subject; the real trouble was to put teeth into the recommendations.

Mr. Wood said he was using all the influence he could to get something done.

Exports to China

In the House of Lords, Lord Wilmot asked for a fresh examination of the whole business of exports to China. Lord Dundee, Minister without Portfolio, said the embargoes had been progressively relaxed and the range of embargoed goods was much more limited now.

ELECTRICAL INDUSTRIES CLUB

The fifth annual general meeting of the Electrical Industries Club was held at the Connaught Rooms, London, W.C.2, on Tuesday last; Mr. E. G. Batt, vice-president, was in the chair.

The report of the committee, circulated in advance, gave an account of the activities during the past year. Mention was made of the election of Mr. A. B. Wildsmith as an honorary member in recognition of his work in founding the Club. At the end of 1958 the membership was 312, a net increase of 48. The total amount collected during the year for the funds of the E.I.B.A. was £169. Appreciation was expressed of the services of Mr. Arthur Lowe, hon. secretary and treasurer, and of Mr. Colin Campbell, hon. social secretary. The accounts showed that the Club's finances were in a healthy state.

At the annual meeting the four vacancies on the general committee were filled by the re-election of Messrs. L. J. Luffingham and C. J. Veness and the election of Messrs. A. H. Boddy and L. H. Hubble. Mr. C. Robertson King, C.B.E., deputy chairman of the C.E.G.B., was elected president to succeed Sir John Hacking and Mr. Batt was re-elected vice-president. Mr. Campbell was re-elected hon. social secretary and Mr. Lowe hon. secretary and treasurer.

The guest speaker at the subsequent luncheon was Marshal of the R.A.F. Sir Dermot Boyle, G.C.B., who spoke about the electrical and electronic equipment of aircraft. Mr. Batt, who presided for the first part of the luncheon, introduced Mr. C. R. King, the new president, and invested him with the badge of office.

First A.C. Passenger Train

The first 25 kV, 50 c/s electrification to operate commercially under the British Railways modernisation scheme was officially opened last Monday by Sir Reginald Wilson, chairman of the Eastern Area Board of the British Transport Commission. The line, which is between Colchester and Clacton and the branch serving Frinton-on-Sea and Walton-on-the-Naze, will serve as a proving ground for equipment to be used in all future electrification schemes. The d.c. electrification between Liverpool Street and Chelmsford and the "gap" between Chelmsford and Colchester will be electrified with the a.c. system and, by the early 1960s, the Great Eastern will be entirely free of steam traction. An illustrated description of the Colchester-Clacton electrification will appear in our next issue.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

At the annual general meeting of W. T. Henley's Telegraph Works Co., Ltd., held on 3rd April it was announced that **Mr. F. W. M. Anderson** and **Sir John Dalton,** directors who retired by rotation under the company's Articles, were not offering themselves for re-election.

Mr. Anderson joined the company in the sales organisation in 1906 and was appointed sales manager in 1925. He was appointed assistant general manager in 1937 and general manager in 1943. He joined the board in 1947.

Sir John Dalton joined the company in 1953 as chairman in succession to

Mr. F. W. M. Anderson

Sir John Dalton

Sir Montague Hughman. He is a well-known figure in the electrical industry and before the war was director and general manager of the County of London Electric Supply Co., Ltd. Sir John, who is a barrister-at-law, has written extensively on the legal aspects of electricity supply and was at one time chairman of the Engineering Legal Society. During the war he was Regional Controller of Fuel and Power for London and South East England. He was knighted in 1942. In 1948 he was appointed a director of the London Power Co. but relinquished this post upon the nationalisation of the electricity supply industry and joined the Cable Makers' Association as its director. He was president of the British Electrical Power Convention held at Torquay in 1956. Sir John was succeeded as chairman of Henley's by Sir Alexander Sim, but continued as a director. He is remaining on the board of Southern United Telephone Cables, Ltd., of which he is chairman, and also on the board of Henley-Simplex Africa (Pty.), Ltd.

Mr. D. A. Senior, M.A., A.M.I.E.E., has been appointed to the newly created post of scientific attaché to the British Embassy in Moscow. He will advise the British Ambassador (Sir Patrick Reilly) on scientific matters and report on Soviet scientific and technical development in the civil field.

Mr. Senior, who is thirty-five, will hold the rank of senior principal scientific officer and will be on the staff of the Department of Scientific and Industrial Research. He has left the United Kingdom for a preliminary visit to Moscow. Since 1950 Mr. Senior has been at the Admiralty Research Laboratory, Teddington.

Mr. J. Pidgeon, who joined the National Inspection Council at the commencement of its operations in January, 1957, as inspecting engineer for the north eastern area, has resigned to take up the position of chairman and managing director of the newly-formed Aycliffe group of companies and the Board of the N.I.C. has appointed **Mr. H. Butterworth,** at present of 2, Westwood Avenue, Linthorpe, Middlesbrough, to succeed him. Mr. Butterworth, who is a holder of the higher national certificate (electrical), served his apprenticeship and thereafter continued to work for several years with W. H. Smith & Co., Ltd., Manchester. He has been with I.C.I., Ltd., in Middlesbrough, responsible for supervisory training, including technical training and more recently with the Nigerian Railway Corporation as senior electrical technical instructor in its training college. Mr. Butterworth takes up his new duties on 20th April.

After twenty-five years as manager of the Bradford branch of Johnson & Phillips, Ltd., **Mr. J. W. Robertshaw,** M.M., A.M.I.E.E., retired on 31st March. A dinner in his honour was held at the Cairn Hydro Hotel, Harrogate, on 1st April, during which Mr. J. B. McRostie, B.Sc., A.M.I.E.E., sales director of Johnson & Phillips, presented him with a cheque on behalf of the directors, and Mr. Bruce-Russell, M.I.E.E., manager for Scotland, made

Left to right: Mr. Bruce-Russell, manager for Scotland for Johnson & Phillips, Ltd., Mr. J. B. McRostie (sales director), and Mr. J. W. Robertshaw, the retiring manager of the J. & P. Bradford Branch

a presentation on behalf of the branch managers.

Mr. Robertshaw joined J. & P. from the Metropolitan-Vickers Electrical Co., Ltd., with whom he was sales engineer for thirteen years.

Mr. G. Hyson, A.M.I.E.E., switchgear sales engineer attached to the Nottingham branch of Johnson & Phillips, Ltd., has been appointed to succeed Mr. Robertshaw as manager of the Bradford branch.

Mr. G. Hyson

Mr. Hyson, who joined the company in 1947, received his practical training in the Electrical Department of Mansfield Colliery from 1937 to 1943, becoming assistant colliery electrical engineer in 1943.

Dr. J. N. Aldington, managing director of Siemens Edison Swan, Ltd., and a director of Associated Electrical Industries, Ltd., is leaving by air on 22nd April for India. After a visit to the Durgapur steelworks where Siemens-Ediswan cables are being installed he leaves for Australia on 26th April. There he will visit company branches and factories, will lunch with the Director-General of the Australian Post Office, and meet government, municipal and business officials. Dr. Aldington goes on to New Zealand on 21st May and will see agents and principal customers. He will leave for home on 25th May.

Mr. H. J. Tyler, purchasing officer of the London Division of the Central Electricity Generating Board, has been appointed regional purchasing and contracts officer for the Eastern, London and South Eastern Region of the Board. Commencing with the Charing Cross, West End and City Electricity Supply Co. at its Bow power station in 1920 and transferring to the London Power Co. in 1928, he had previously held the posts of senior accountancy assistant and stores controller to the London Power Co.

Mr. L. A. Pughe, sales director of Sumo Pumps, Ltd., a member firm of Stone-Platt Industries, Ltd., leaves London today (Friday) by air for Kenya, the Rhodesias, South Africa and the Sudan.

The annual dinner and dance of the **I.E.E. North Midlands Centre** was held on 10th April at the Refectory, Leeds University. The new venue

At the annual dinner-dance of the I.E.E. North Midlands Centre. Left to right: Mr. A. J. Coveney (immediate past-chairman), Mrs. Coveney, Mr. J. D. Nicholson (chairman), Mrs. Nicholson, Mr. H. A. Carr (hon. secretary) and Mrs. Carr

permitted the attendance of considerably more guests and Mr. J. D. Nicholson (chairman) presided over a gathering of some 420.

Sir Ronald German, C.M.G., has been appointed deputy director general of the Post Office. Sir Ronald first joined the Post Office in 1925. He later served for a time in the Treasury. From 1942 to 1945 he was assistant director of the Sudan Posts and Telegraphs Department and since 1950 he has been Postmaster General of East Africa.

Mr. V. A. Pask, C.B.E., has been appointed managing director of John Brown Land Boilers, Ltd. Before joining John Brown Mr. Pask was chief engineer of the former Central Electricity Authority from 1948 to 1955. **Mr. W. V. Wright** has been appointed sales director of the company.

Mr. A. W. Ford, B.Sc.(Eng.), A.M.I.E.E., who writes in this issue on "Brushless Alternators" (see page 711), was educated at King Edward VI Grammar School and University College, Southampton (now the University of Southampton). After a period as a works trainee with Crompton Parkinson, Ltd., Chelmsford, he joined the General Electric Co., Ltd., Witton, in 1937 as assistant insulation engineer, being transferred to electrical machine design work in 1946. Mr. Ford became chief a.c. designer with Harland & Wolff, Ltd., Belfast, in 1951, and three years later was appointed chief designer of electrical machines in the Plessey Co.'s Aircraft Electrical Division at Ilford. In 1956 he joined the English Electric Co.'s Aircraft Equipment Division at Bradford as a senior designer.

Mr. A. W. Ford

At the annual dance and cabaret of Lancashire Dynamo & Crypto, Ltd., held on 10th April at the Porchester Hall, Bayswater, **Mr. F. L. Ingram,** a director of Crypto, Ltd., was presented with a gold watch to mark his twenty-five years' service with the Lancashire Dynamo group. The presentation was made by Mr. D. C. Lorkin, managing director of Lancashire Dynamo.

Changes are announced in the board of Avo, Ltd., which recently became a member of the Metal Industries Group. Joining the board are **Sir Charles Westlake,** chairman of Metal Industries, Ltd., **Mr. J. Black,** a director of Metal Industries, and **Mr. H. O. Houchen,** managing director of Brookhirst Igranic, Ltd. They replace Mrs. E. Rawlings, Mrs. M. Brook and Mrs. I. E. Widdows, who have resigned. Sir Charles becomes chairman of the board, with **Mr. J. H. Rawlings,** managing director of Avo, as deputy chairman. The other directors, who are unchanged, are **Mr. F. H. Padfield, Mr. H. S. Macadie** and **Mr. S. R. Wilkins.** Mr. Rawlings is to be appointed shortly to the board of Brookhirst Igranic, Ltd.

On 9th April **Mr. A. Griggs,** the house engineer at the G.E.C. head office, Magnet House, Kingsway, W.C.2, completed 50 years' service with the company and to mark the occasion he received a presentation from Mr. Leslie Gamage, the chairman. Mr. Griggs' father was the first G.E.C. employee to be taken on by Lord Hirst, joining the company in 1882; he too completed 50 years with the company, retiring in 1932. Mr. Griggs' son has completed 21 years' service with the company; he is manager of the Contract Department in Bombay.

Mr. J. M. Paterson, A.M.I.E.E., manager of the Dundee branch of the General Electric Co., Ltd., has retired after thirty-seven years with the company. He joined the Peel Conner Telephone Works, Salford and Coventry, which became merged with the G.E.C. His successor as manager is **Mr. R. H. B. Candow,** who has been assistant manager for twenty years.

Mr. J. F. Roper, A.M.I.E.E., has been appointed regional engineer of the British Lighting Council for the areas covered by the South Eastern and Southern Electricity Boards. He has had previous experience of this type of development work, for after joining the Lighting Service Bureau in 1946 he was responsible for its activities in Scotland from 1951 to 1953 when he returned to London in a senior position on the national staff, and for some time specialised in street and industrial lighting.

Mr. J. F. Roper

A luncheon party was held at Kettners' Restaurant, London, on 8th April when **Miss H. J. Savage,** of the accounts department of Siemens Edison Swan's Ponders End factory, was presented with a cheque, on behalf of her friends, by Dr. J. N. Aldington, group managing director of Siemens Edison Swan, Ltd., on the occasion of her retirement after 47 years' service with the company.

Mr. G. H. Moir, area manager in Northern Ireland for the General Electric Co., Ltd., for the past thirty-one years, has retired. Before joining the G.E.C. he was for five years with

Mr. Leslie Gamage (chairman, G.E.C.) making a presentation to Mr. A. Griggs

the British Thomson-Houston Co., Ltd., in Belfast and Rugby. Mr. Moir commenced his career in the Electrical Department of Harland & Wolff, Ltd., and later had experience in South Africa in the Transvaal gold mines and in civil engineering. **Mr. J. McK. Stewart** has been appointed to succeed him as manager of the Belfast branch of the G.E.C. He has spent all his business life in the electrical industry in Northern Ireland.

Mr. B. E. Bear has been appointed manager of the Illuminating Engineering Department of the Strand Electric & Engineering Co., Ltd., and will be responsible for all special lighting projects. He has been with the company since 1936 and in recent years has concentrated on television production lighting. Mr. Bear is lighting consultant for the *Daily Mail* Ideal Home Exhibition.

Mr. J. T. Wood has been appointed manager of the company's Export Department. He has been with the Strand Electric since 1946. Before

Mr. B. E. Bear

Mr. J. T. Wood

service in the last war he was with the Western Electric Co. He is the inventor of the three valve direct electronic dimmer used by the Strand Electric & Engineering Co. Since joining the company he has travelled extensively and almost continuously on stage and television lighting export contracts.

Mr. R. A. Senior has been appointed director and manager of the John Thompson Instrument Co., Ltd., Wolverhampton. He joined the company twelve months ago to fill the newly created post of sales manager. For a number of years Mr. Senior was Midlands area manager for Kelvin & Hughes, Ltd. He is a member of the Society of Instrument Technology and of the Sales Managers' Association.

Mr. C. S. Gilbert has been appointed North of England sales engineer and is now at Sunlight House, Quay Street, Manchester.

Last week at the Cripplegate Institute, London, E.C., the **G.E.C. Dramatic Society** presented "Sailor Beware," the three-act comedy by Philip King and Falkland Cary. Always maintaining a high standard, the G.E.C. players this time excelled in the balance and timing of their acting. Anna Powell, as "Emma Hornett"—something of a termagant but with a good heart—played her strenuous part with convincing thoroughness and she was admirably supported (or opposed) by the other members of the cast—Mary Andrew, Rita Harley, Fred Coker, Nigel Steeley, Tony Manton, Pat Townsend, Shirley Linge and Keith Clifton. The production was by Lionel Johnson. A donation from the proceeds is being sent to the Electrical Trades' Commercial Travellers' Association.

With the object of providing customers with an improved and co-ordinated service, at the beginning of the year the "Alliance Wholesale," "Simpson Baker" and "Sloan" undertakings were amalgamated and now trade as divisions of Edmundsons Electrical Wholesalers, Ltd. Arising out of this amalgamation that part of the country covered by Edmundsons has been divided into areas for which area managers are to be appointed. **Mr. N. S. Richardson,** a director of Edmundsons Electrical Wholesalers, Ltd., and manager of the Croydon branch, has been appointed area manager for the South Eastern Counties, currently consisting of Croydon and Maidstone branches.

Mr. N. S. Richardson

Mr. H. Hanks, Associate I.E.E., has been elected to the board of Alfred Ellison, Ltd., West Bromwich. Mr. Hanks was general sales manager of George Ellison, Ltd., for many years until 1952, when he was appointed general manager of Alfred Ellison, Ltd. He has served with the Ellison companies for 41 years, joining the late Mr. George Ellison in 1918 after service with Wolseley Motors, Ltd., and the Electric & Ordnance Accessories Co., Ltd.

Mr. E. A. Skinner has been appointed general manager of Alfred Ellison, Ltd., in succession to Mr. Hanks. He joined the Ford Motor Co., Ltd., Dagenham, in 1936, and later served as a production executive at the company's Imperial Foundry until 1949 when he joined Guest, Keen & Nettlefolds, Ltd., in a similar capacity. He served with the production operational research team of the British Cast Iron Research Association from 1951 to 1953 when he was appointed

Mr. H. Hanks

Mr. E. A. Skinner

works manager of Hale & Hale (Tipton), Ltd. Mr. Skinner has been assistant general manager of Alfred Ellison, Ltd., since 1955.

At the annual general meeting of the Federation of British Industries held in London on 8th April, **Mr. W. H. McFadzean,** Companion I.E.E., was elected president of the Federation for the coming year. He succeeds **Sir Hugh Beaver** who has retired after holding office for two years.

Mr. W. H. McFadzean

Mr. McFadzean has been chairman and managing director of British Insulated Callender's Cables, Ltd., since 1954. Over the last twelve years or so he has spent several months each year overseas in the promotion of B.I.C.C. interests. He is keenly interested in the development of the Commonwealth. As vice-chairman and industrial leader of the Advisory Council on Middle East Trade, set up by the President of the Board of Trade, he recently completed an extensive tour of certain countries in the area. He has temporarily retired from this post as a result of his new duties with the F.B.I.

Mr. K. R. Sturley, B.Sc., Ph.D., M.I.E.E., who writes in this issue on "Technical Training in America" (page 717), received his electrical engineering education at Birmingham University. He was a research engineer with Marconi's Wireless less Telegraph Co., Ltd., in 1930-31 and in 1932 was appointed lecturer and assistant principal at the Marconi College. Since 1945 he has been head of the B.B.C. Engineering Training Department. He was chairman of the Radio Group of the I.E.E. South Midland Centre for the 1949-50 session and chairman of the same Centre in 1952-53. He has been chairman of the City of Birmingham Electrical Engineering Advisory Committee since 1953 and he is also a member of the City and Guilds Electrical Engineering Group Committee. Dr. Sturley has written a number of books on radio subjects.

Dr. K. R. Sturley

The annual presentation concert of the Social and Athletic Club of the **Telegraph Construction & Maintenance Co., Ltd.,** was held at Telcon Works, Greenwich, on 7th April. Trophies, awards and certificates were presented by Sir John Dean, chairman of Telcon.

OBITUARY

Mr. A. R. Blandford, M.I.E.E., consulting engineer to the English Electric Co., Ltd., and formerly chief electrical engineer of the company, died on 11th April. Mr. Blandford, who was born in 1891, received his training with the Walsall Electric Co., of which he was later assistant manager. He then joined the Electric Construction Co., Ltd., as assistant switchgear engineer and in 1923 commenced his association with the English Electric Co. in a similar capacity. He subsequently held the successive appointments of assistant chief switchgear draughtsman, chief switchgear engineer, and chief engineer and manager of the Switchgear Department, becoming chief electrical engineer of the company in 1949, from which position he retired in 1957 although he continued to serve as consulting engineer. He had represented the English Electric Co. on the B.S.I., B.E.A.M.A. and the I.E.C. and was a British representative on C.I.G.R.E. He was a director of the English Electric Export & Trading Co. from 1948 to 1957 and chairman of the I.E.E. South Midlands Centre for 1954-55.

Mr. Ernest Taylor, who was chief electrical engineer with the Sheepbridge Coal & Iron Co., Ltd., Chesterfield, until he retired in 1951, died on 31st March at the age of seventy.

Mr. A. J. Burbidge.—The death is reported of Mr. A. J. Burbidge, who retired in 1951 from the position of manager of the Lighting Fittings Department of the General Electric Co., Ltd. Mr. Burbidge joined the G.E.C. in 1905 as a boy in the stockroom and rose to be manager of the Lighting Fittings Department, which position he held for twenty years. He was president of the Electric Light Fittings Association from 1946 to 1948 and was the Association's representative on the Fair Trading Council for many years.

The late Mr. A. J. Burbidge

Mr. Harry Howitt, late secretary and director of the British Radio Valve Manufacturers' Association, died on 5th April at the age of eighty-five.

Mr. H. S. Boutle, manager of the Eastern Division of Electrolux, Ltd., died in a road accident on 25th March. Mr. Boutle, who was fifty-eight, had been with Electrolux (apart from war service in the Royal Navy) since 1931, and had been manager of the Eastern Division since 1947.

Mr. G. M. Krzhizhanovsky, whose death in Moscow on 31st March is reported by *Reuter,* was largely responsible for industrial electrification in Russia. This work included the laying of the Moscow cable network in 1910 and the building and putting into commission of Russia's first peat-fired power station (in 1911). In 1920 he became chairman of the State Commission for Electrification and from 1921 to 1930 he was director of the State Planning Commission.

Sixty Years of Wholesaling

THIS year the Sloan Electrical Co., Ltd., celebrates its diamond jubilee and, to mark the occasion, an exhibition entitled "Carbons to Counters" is being held this week at the company's London headquarters, Ferndale Road, Brixton, S.W.9. Devised to show the progress made in the equipment handled by the company since its formation on 15th April, 1899, the exhibition includes early examples of cables, switchgear, radio valves, heating and cooking appliances, vacuum cleaners, lighting fittings, etc., and their modern counterparts.

Much of the equipment has been lent by manufacturers. It includes one of the earlier Belling electric cookers (1920 vintage) and, in the cleaning section, several early British Vacuum Cleaner & Engineering Co. models. A street lighting arc lamp (1900-5) from the Morgan Crucible Co. appears to be in as good a condition as when first made.

Arc carbons played a large part in the founding of the Sloan company and for this reason a display of carbons at the exhibition (provided by the Ship Carbon Co.) was of more than usual significance. Towards the end of the last century Mr. L. G. Sloan, J.P., an agent for pens and pencils, was invited by his suppliers to import arc carbons on behalf of the German firm who supplied their graphite. As a result the company was founded and for some years it concentrated on the sale of "Conradty" arc lighting carbons, carbon brushes and electrodes.

Later, sole selling rights were acquired for the insulated wires and cables made by Riffelmacher & Engelhardt of Nuremberg, and by 1912 the Sloan catalogue (a copy of which was displayed at the exhibition) contained a representative range of wiring accessories, cartridge fuses, insulators, lamps and shades. When 1921 brought the first radio broadcasts the company was early in the field with stocks of apparatus. In the 'thirties the first of the "Summit" range of domestic appliances, an electric iron, was marketed, followed by vacuum cleaners and kettles, and by 1949 the company was actively engaged in the marketing and distribution of all types of electrical products.

With the growth of the company the number of branches has also increased. Branches were opened in Manchester (1907), Edinburgh (1913), Bristol (1923), Exeter (1926), Ealing (1935), Leyton (1941), Peckham (1946), and in 1950 the company improved its service to Cornwall by opening the first "self-service" electrical wholesaling branch at Truro. The success of this enterprise led to its extension to the new Bristol premises opened last month.

In 1952 the Sloan company was acquired by Edmundsons Electric Co., Ltd. Alliance Wholesale, Ltd., and Simpson, Baker & Co., Ltd., were already members of the Edmundsons Group and the co-ordination of the three companies was achieved by their integration through the Sloan Electrical Co. in January last, the name of the company being changed to Edmundsons Electrical Wholesalers, Ltd.

A general view of the Sloan Electrical Co.'s "Carbons to Counters" exhibition

INDUSTRIAL NEWS

Power Station Men's Claim

The executive of the National Union of Enginemen, Firemen, Mechanics and Electrical Workers, representing nearly 40,000 workers in electric power stations, decided last week to seek a reduction of working hours from 44 to 40 a week and also a substantial pay rise. The decision will be reported to four other unions which are also represented on the National Joint Council for the Electricity Supply Industry. They are the Electrical Trades Union, the Amalgamated Engineering Union, the Transport and General Workers' Union, and the National Union of General and Municipal Workers. It is expected that later this month the unions will agree to a joint claim to be put to the Central Electricity Generating Board.

The five unions represent altogether about 120,000 manual workers in the electricity supply industry. Last May they received an increase of 8s 3d a week in the form of a "productivity allowance," which was later consolidated into the basic rates, leading to an increase in overtime and holiday pay.

Aluminium Production in New Zealand

The Northern Aluminium Co., Ltd., announces that it will shortly establish a new branch of its aluminium fabricating industry in New Zealand. This decision is the outcome of discussions held between the company and the New Zealand Government over several months. The new plant will have an initial production capacity of 5,000 tons per annum of aluminium sheet and foil products and 2,000 tons per annum of aluminium wire and cable for electrical transmission lines. The situation of the plant has yet to be decided; alternative sites in the North and South Islands of New Zealand are being considered. The project will require a total investment of approximately £2,000,000, almost the whole of which will be provided by Aluminium, Ltd., and the Northern Aluminium Co., Ltd. The general manager of the New Zealand branch will be Mr. T. E. L. Ashley, who has spent over thirty years in the aluminium industry in England and has been manager of the company's plant at Banbury for the past twenty-five years.

New G.E.C. Subsidiary

Service, which may include all preliminary survey and planning work as well as the actual installation of plant and equipment, is playing an increasingly important part in many overseas contracts. The General Electric Co., Ltd., has, therefore, in order to make its experience more readily available to overseas customers, formed a new company, G.E.C. Overseas Services, Ltd., which will cover both the supply of goods and the provision of the associated service requirements in certain overseas contracts.

The company will operate as main or sub-contractors and is prepared to work in conjunction with civil and electrical contractors, mechanical engineers or others on complete "turnkey" contracts or on specific projects. Complete airfield electrification, lighting schemes, and the electrification of buildings are typical of the projects which come within the scope of the new company. Similarly it can take on work in the engineering and telecommunications fields. The directors of the new company, which commenced business on 1st April, are Mr. Leslie Gamage, Mr. D. G. W. Acworth, Mr. R. N. Millar and Mr. H. C. Margrett, who is also the general manager.

The new company may operate anywhere overseas, as occasion demands. It is in no way intended to replace or duplicate services already rendered by G.E.C. overseas branches, but is rather available to supplement such services. It can also enter into a contract direct with an overseas organisation if, for any reason, it is preferable for such a contract to be placed with a company registered in the United Kingdom. The new trading organisation will undertake the bulk of the work formerly handled by the G.E.C. Business Development Department in London, which has been discontinued, the staff concerned with this type of work being absorbed into the company.

E.D.A. Annual Meeting

The annual meeting of the British Electrical Development Association is to be held at the Savoy Hotel on 12th May. As usual, it will be preceded by the annual luncheon at which the principal guest and speaker will be Sir Hugh Beaver, immediate past-president of the Federation of British Industries.

Instruments Handbook

The United Science Press, Ltd., in association with the Scientific Instrument Manufacturers' Association, has issued a new publication, "British Instruments Directory and Buyers' Guide." This combines in one volume of some 600 pages the information previously given in "British Scientific Instruments," published by S.I.M.A., and the "Instrument Directory and Buyers' Guide," published by United Trade Press, Ltd., both of which have now been discontinued. The new publication is an authoritative guide to all sources of supply of British instruments for science and industry, together with their components. In addition to comprehensive classified lists of instruments and components, the book includes a four-language glossary of headings, a list of specifications directly bearing on instrument matters, a list of consultants, engineers and installers of instrumentation schemes, alphabetical lists of instrument and component manufacturers with overseas agents, and of trade names, and a comprehensive manufacturers' section describing their products. A foreword is contributed by Sir David Eccles, President of the Board of Trade. The directory is obtainable from the United Science Press, Ltd., Boswell House, 9, Gough Square, Fleet Street, London, E.C.4, price £2 2s.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

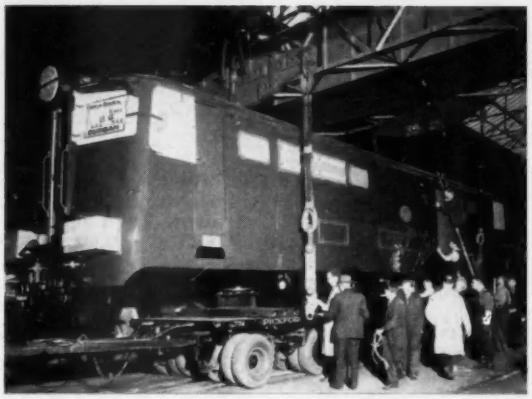
ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £238 15s 0d
Fire Refined 99·70%	ton £237 0s 0d
Fire Refined 99·50%	ton £236 0s 0d
COPPER Tubes	lb 2s 3½d
Sheet	ton £269 10s 0d
H.C. wire and strip ..	ton £293 15s 0d
LEAD, English ..	ton £68 5s 0d
Foreign	ton £67 0s 0d
MERCURY	flask £78 0s 0d
TIN, block (English) ..	ton £779 0s 0d
ZINC, G.O.B. Foreign	ton £71 10s 0d
BRASS Tubes (solid drawn)	lb 2s 0½d
Wire	lb 2s 8d
PHOSPHOR BRONZE Wire	lb 4s 1¾d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 28d—28½d

Cable for Indonesian Airfield

As part of a large export order for airfield lighting cables at Kemajoran, the principal airport serving Djarkarta, Indonesia, Siemens Edison Swan, Ltd., have delivered over 13,000 metres of 5 kV butyl insulated polychloroprene sheathed cable. This was manufactured to American standards and the requirements of the American Civil Aeronautical Administration. It is the first extensive order for this class of cable to be undertaken by Siemens Edison Swan. The order also included a total of 25,000 metres of v.r.i. cable for operation at 600 V and 2,000 V.

Locomotives for South Africa

The accompanying picture was taken at the Stockton Works of Metropolitan-Vickers–Beyer, Peacock, Ltd., recently and shows a 2,200 h.p. electric locomotive being loaded on to a specially adapted road trailer for transport to Liverpool and shipment to South Africa. It marks the com-



The first of 135 electric locomotives being loaded at the Stockton Works of Metropolitan-Vickers —Beyer, Peacock, Ltd., for dispatch to South Africa

mencement of deliveries of an order for 135 locomotives placed by the South African Railways Administration with Metropolitan-Vickers South Africa (Pty.), Ltd., on behalf of the Metropolitan-Vickers Electrical Export Co., Ltd. The delivery rate is planned to reach five locomotives a month by the end of this year.

A.S.E.E. Year Book

The eighth edition of the Year Book and Technical Guide, for 1958-59, of the Association of Supervising Electrical Engineers is now available from the Association, 23, Bloomsbury Square, London, W.C.1 (price 5s post free). As in previous editions, the first part is devoted to matters pertinent to the Association, and includes particulars of its constitution, officers, objects and rules and reference to the Electrical Engineers' Exhibition. This is followed by the technical section of over 100 pages which has been rearranged into the following six broad classifications:—Terms, units, definitions, etc.; regulations; wiring and electrical installation subjects; heating and ventilation; electronics; and calculations and tables. New material includes articles on solderless terminals and cable lugs, miniature circuit-breakers, trunking and duct wiring capacity, private mobile radio services, developments in basic devices, and the Clean Air Act.

British Nuclear Energy Display in Milan

One of the features of the International Samples Fair in Milan, which opened last Sunday, is a nuclear energy building in which nine nations are demonstrating their atomic advances. The United Kingdom Atomic Energy Authority has one of the largest exhibits in this section, covering 3,500 sq ft. It illustrates the industrial development of power reactors for electricity production, both in the United Kingdom and overseas, and the extensive range of radioactive isotopes which the Authority supplies to countries all over the world. The power reactor section, which makes special reference to the construction by British industry of the Italian power station at Latina, emphasises the technical experience gained by the U.K. in reactor fuel element design and fabrication. Power station models include a "cut-away" of Calder Hall on which visitors are able to carry out, in simulated form, the control operations of a nuclear reactor.

A number of ways in which radioactive isotopes can be used are demonstrated.

A multi-language cinema, with separate and simultaneous sound tracks in Italian, French, German and English, shows films dealing with the British nuclear power programme, the use of radioisotopes in industry, metallurgical research and animated diagrams illustrating the principles of nuclear fission and the way in which a reactor works.

Transformers for Singapore

An order for transformers, valued at £20,000, has been received from the Electricity Department of the City Council of Singapore by the Gresham Transformer Group. It consists of twelve 500 kVA and fifteen 300 kVA transformers.

Foundry to Close

Metal Industries, Ltd., announces that it is closing one of its smaller subsidiaries, Ferrous Castings, Ltd., Warrington, Lancs. The company, which was founded in 1919, manufactures iron castings for the engineering and electrical trades. The closure will not take place until July and £14,000 is being set aside for final payments to the company's employees over and above their normal salaries or wages. Adverse trading conditions, coupled with a continued decline in the use of grey iron castings by companies within the group, have involved Ferrous Castings in substantial losses over a period. Sir Charles Westlake, chairman of Metal Industries, has made it clear that the decision to close the company in no way reflected upon the management, staff or workpeople.

Caroline Haslett Memorial

An advertisement in this issue (Sup. 131) invites applications from women for the award of a travelling exhibition in domestic electrification. The sponsors are the Management Committee of the Caroline Haslett Memorial Fund (Electrical Section). Full particulars are contained in the advertisement.

Printed Circuit Exhibition

An exhibition of printed circuit components held by the Industrial Division of Formica, Ltd., at their Regent Street, London, showrooms closes today (Friday). The display includes a number of television and radio sets lent by the manufacturers to illustrate the use of printed circuits, especially the Formica copper-clad laminate. This material consists of a Formica industrial laminate to which copper foil is permanently bonded. Circuits can be printed on the copper foil by using an acid-resistant ink and immersing the sheet into a suitable acid bath.

Winders for the N.C.B.

The value of recent orders for winders placed by the National Coal Board with the General Electric Co., Ltd., now totals nearly £400,000. They include two winders for the Birch Coppice Colliery, rated at 400 h.p. and 1,490 h.p., a 1,450 h.p. machine for Western Colliery, one of 1,900 h.p. for Caerau Colliery, and another of 1,100 h.p. for Cortonwood, for which a 2,000 h.p. winder is already on order. With

A delegation from the Russian plastics industry during a recent visit to the Ekco Works, Southend-on-Sea, showing (left to right): Mr. Nikolai Novojilov (Russian Research and Development Institute for Chemical Industry Machinery); Mr. D. A. G. Dougal (Ekco industrial engineer); Mr. Alexander Sokolov (Moscow Region Economic Council); Mr. Ivan Karataev (vice-president of the Council and leader of the delegation) and an interpreter

the exception of the 1,490 h.p. rectifier winder, all the equipments are a.c. and have compensated dynamic braking. Mechanical parts of the Cortonwood winder are being supplied by Fullerton Hodgart and Barclay, Ltd., and of the four other winders by Robey & Co., Ltd.

Scottish All-Electric Housing Exhibition

An All-Electric Housing Exhibition was held at the City Halls, Perth, from 7th to 11th April by the North of Scotland Hydro-Electric Board. Leading manufacturers of domestic electrical equipment co-operated in the exhibition, which was opened by Mrs. Thomas Johnston, wife of the chairman of the Board. Speaking at the exhibition, Mr. Johnston said its purpose was to popularise and sell in abundance electricity gadgets. It was designed to show the great advantages to the consumer of using electric power for cooking, room heating, washing, refrigeration, shaving, hair drying, clothes drying, ironing, water heating, and other amenities—to say nothing of clean air.

Canadian Instruments Contract

Marconi Instruments, Ltd., through its agents in Canada, the Canadian Marconi Co., has received an order valued at $200,000 from the Canadian Department of Defence Production for telecommunication measurement equipment. In all nearly two hundred instruments are to be provided, including signal generators, portable frequency meters, oscilloscopes, wave analysers, and transmission test sets.

Railway Signalling at Newcastle

A new power signalling installation controlling ten miles of track and incorporating colour light signals and route relay interlocking was brought into operation at Newcastle Central Station on 12th April. The installation, in which there are 641 route switches, is housed in an air-conditioned signal box situated above Nos. 9 and 10 platforms. Previously this section of track was controlled by four separate signal boxes. In the area controlled by the new installation there are 94 colour light three or four aspect signals of the searchlight type, 61 of these having route indicators. For shunting movements there are 170 subsidiary signals, 84 of which embody "calling on" indicators and work in association with the colour light signals. The track work for this section includes 131 sets of points, of which 13 are switch diamond crossings. The whole of the section is divided into 260 track circuits and trains occupying any of these circuits automatically control the relevant signals and points.

The public supply is taken to the 660 V busbars through oil-filled circuit-breakers, and transformers feed the 110 V busbars in the signal box. From the 110 V bars supplies are taken to the d.c. supply rectifiers, indication transformers and the distribution system in the relay room. The supply transformer for the subsidiary signals has both 110 and 55 V secondary outputs for day and night use.

Opportunities for School Leavers

In the 1959 edition of the "Directory of Opportunities for School Leavers" the openings for employment and the opportunities and prospects offered by 134 industrial and commercial organisations and Government Departments are set out in detail. A classified index summarises in tabular form such information as the size of organisations and the qualifications required of entrants, and there is a series of articles on subjects including the art of being interviewed, technical training and apprenticeships, and careers in the professions. The Directory is published by Cornmarket Press, Ltd., 1, Lower James Street, London, W.1, price 8s 6d, or 5s for a paper-back edition.

Hellermann Bulletin

Hellermann, Ltd., have sent us a copy of the first issue of the "Hellermann News Sheet," which will be published at bi-monthly intervals. The bulletin is intended to draw attention to the company's products, and the first issue gives brief particulars (with illustrations) of a pneumatic sleeve-fitting tool, a plastics radio cabinet, "Suprafix" spring-loaded terminal blocks, and a wire stripper.

Interior of the control room at Newcastle Central Station

Materials Handling Conference

The first International Conference of the Institute of Materials Handling will be held from 6th to 8th May at the Waldorf Hotel, London, W.C.2. In addition there will be a number of works visits, and the conference will conclude with the annual banquet of the Institute, to which ladies are invited. The Conference fee is £10 10s (banquet 35s extra), and particulars and application forms can be obtained from the Conference Office, 42, Manchester Street, London, W.1.

Trade and Technical Literature Competition

The Royal Institute of British Architects and the Building Centre are once again to act as joint sponsors of a competition for manufacturers' trade and technical literature. Previous competitions were held in 1957 and 1958. Conditions for the 1959 competition will be available from the Building Centre, 26, Store Street, London, W.C.1, towards the end of this month.

Exhibition of Machine Tools

Burton Griffiths & Co., Ltd., are holding an exhibition of machine tools and small tools at the B.S.A. Tools Division, Mackadown Lane, Kitts Green, Birmingham, 33, from 20th to 24th April. A comprehensive range of machine tools will be exhibited, including a number being shown for the first time.

Pipe Bending

A manual published by Chamberlain Industries, Ltd., Staffa Works, Staffa Road, Leyton, London, E.10, provides information on all aspects of pipe bending for steam, gas and copper tubes.

Instrument Show

The fifth international instrument show organised by B. & K. Laboratories, Ltd., was held at their Instrumentation Centre at 4, Tilney Street, Park Lane, London, W.1, from 6th to 10th April. A wide range of instruments and instrumentation equipment was shown by 60 exhibitors from all parts of the world.

Radiotelephone Equipment for Iranian Oilfield

Pye Telecommunications, Ltd., Cambridge, has been awarded a contract by the Iranian oil operating companies for providing a radio communications system between Kharg Island in the Persian Gulf, the oilfield at Gachsaran and the Agha Jari oilfield. A 12 channel v.h.f. system will be installed using frequency modulated multiplex radiotelephone equipment. The chain of terminal and repeater stations will cross a total of 160 miles

of sea, coastal plains and mountain ranges. To facilitate servicing the same type of multiplex receivers and 15 W transmitters will be used in all the terminal and repeater stations, although in some of the more difficult transmission areas the 15 W transmitters will be boosted by 50 W r.f. amplifiers.

European Conference on Nuclear Energy Industrial Prospects

The O.E.E.C. and the European Nuclear Energy Agency (E.N.E.A.) are organising a European conference for industrial management on industrial prospects in nuclear energy, to be held at the Palais des Congrès, Stresa, Italy, from 11th to 14th May. Speakers from the United Kingdom will include Sir Hugh Beaver (president, F.B.I.) and Sir William Cook (member for engineering and production, United Kingdom Atomic Energy Authority).

New Benjamin Catalogue

From the Benjamin Electric, Ltd., Brantwood Road, Tottenham, London, N.17, we have received a copy of a comprehensive catalogue of the company's industrial and commercial lighting equipment. The first part of this handsomely-produced publication contains a great deal of technical sales data and general information. Then follow sections covering fittings for fluorescent tubes and bulbs, tungsten lamps, and mercury lamps with a final section on outdoor fittings. Illustrations, full specifications and prices are given in each case. The catalogue has a complete index and each section is printed in a distinctive colour with a thumb tab to match.

"Data Processing"

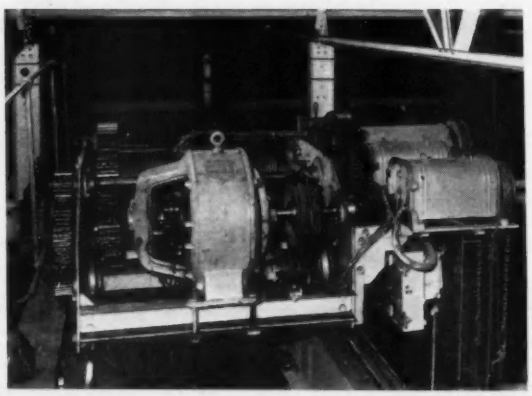
The second issue of this quarterly journal (April-June) includes illustrated articles on a new "automatic keyboard instructor" machine; advice on installing computers; and a number of applications of data processing equipment. The journal is designed for "top management and executives" and is published by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, at 25s per copy; annual subscriptions £4 home and overseas, $12 United States and Canada.

Television Link

The G.P.O. has placed an order with Marconi's Wireless Telegraph Co., Ltd., for the supply and installation of a super high frequency and ultra high frequency wideband radio link between Birmingham and Norwich. The link, which is to be twin-path and bi-directional, will carry B.B.C. television programmes between the two cities, serving, *en route*, the new B.B.C. transmitter near Peterborough.

Long-Service Motor

At the beginning of the century, among the first thousand motors manufactured at the Trafford Park Works of the Lancashire Dynamo & Motor Co., Ltd., was a 4 h.p. d.c. motor, which, although installed fifty-seven years ago, is still in service as the hoisting motor on an overhead crane in an engineering factory in the north-east of England. It bears the original design of shield as used up to 1918 when the horizontal bar was added to form the present design for Lancashire Dynamo & Crypto products.



A Lancashire Dynamo motor which is still in use after fifty-seven years' service

Liverpool Lighting Conference

The British Lighting Council is holding a conference on industrial lighting on 29th April at the Strand Hotel, Brunswick Street, Liverpool, 2.

I.E.E. Telephone Number

The telephone number of the Institution of Electrical Engineers has been changed to Covent Garden 1871.

Trade Announcements

Mr. L. G. Orriss has been appointed sales representative of the **Normand Electrical Co., Ltd.,** and **Neco Geared Motors, Ltd.,** for London and the Home Counties except Kent and Essex, and Mr. W. A. Shufflebottom has been appointed sales representative for Lancashire, Yorkshire and Cheshire.

Pyrotenax, Ltd., announces that from Monday next the address of its London office will be 54, Victoria Street, S.W.1 (telephone: Victoria 3745/9). The new premises include a well-appointed display room and two fully equipped demonstration rooms for instructional and refresher courses in the application of mineral insulated cables. The company's Leeds office has been transferred to larger premises at East Parade Chambers, 10-12, East Parade, Leeds, 1 (telephone: Leeds 27826).

The **David Brown Corporation, Ltd.,** London, has announced that it is to acquire a substantial minority interest in Foote Bros. Gear & Machine Corporation of Chicago. The acquisition is subject to the approval by stockholders of Foote Bros. of a reclassification of the company's stock, proposals for which are to be submitted at a meeting to be held on 6th May.

A number of new appointments have been made in the domestic appliance sales force of the **English Electric Co., Ltd.** In the Southern Electricity Board area, Mr. G. S. E. Wilkinson, from the company's Slough office, covers the Newbury and Basingstoke district. Mr. H. V. Young has been promoted to senior representative at Leicester, responsible for Leicester, Warwickshire, Coventry, Derby and Burton Sub-Areas, and Mr. R. T. Adamson will operate in the Lincolnshire and Northamptonshire territory. From the Sheffield branch, Mr. D. Sanderson covers the Nottingham Sub-Area, Mansfield, Ilkeston and Matlock, and Mr. G. M. Tennant is responsible for Sheffield, Grimsby, Barnsley and Doncaster Sub-Areas. In the Midlands Electricity Board area Messrs. B. R. Bufton and R. F. Farmer have joined the divisional staff in Birmingham.

The Clarke (Electrical) Co., Ltd., and **H. H. Electrical (London), Ltd.,** have moved to 216, Kensington Park Road, London, N.11 (telephone: Park 0046/7/8).

The telephone number of the Bournemouth depot of **British Insulated Callender's Cables, Ltd.,** is now Bournemouth 36223.

Crypto, Ltd., North Circular Road, London, N.W.10 (a member of the Lancashire Dynamo group of companies), has transferred its Leeds branch office to a new building at Leylands Road, Regent Street, Leeds. The new premises include a large showroom, administration accommodation and a fully equipped workshop for servicing Crypto food preparing machines. Mr. W. M. Swain remains as the Leeds branch manager.

Falcon Tools (Hampton), Ltd., has recently taken over the business of H. R. Morgan (Metal Pressings), Ltd., manufacturers of standard transformer shrouds, covers and end frames.

Weldcraft, Ltd., which recently became part of the G. D. Peters group of companies, has moved to Windsor Works, Slough, Bucks. (telephone: Slough 23201).

Short & Mason, Ltd., announce that as from 1st May they are opening a branch office at 30a, London Road, Manchester, 1 (telephone: Central 3044). Mr. W. K. Gregson has joined the company as the northern area representative and will operate from this address.

The Shaw Savill liner "Southern Cross"

Marine, Welding and Nuclear Equipment

SURVEY OF THE ENGINEERING EXHIBITION AT OLYMPIA

THE twenty-second biennial Engineering, Marine, Welding and Nuclear Energy Exhibition was to be formally opened yesterday (Thursday) by Sir Edward W. Thompson, M.A., J.P., president of the British Engineers' Association and chairman of John Thompson, Ltd. The Exhibition, which occupies the whole of Olympia, consisting of three halls and galleries with an area of more than 250,000 sq ft containing displays by some 500 exhibitors, will remain open until 30th April.

Nuclear energy first appeared in the title of the Exhibition in 1957. Since then the majority of British engineering firms have become involved, in one way or another, in nuclear engineering. As a result, a large proportion of the firms at the Exhibition are displaying examples of nuclear equipment or research work on their stands. Three colour sound films on nuclear engineering are being shown on the British Engineers' Association's stand. These films, "Atomic Power," "Radioisotopes in Industry" and "Metals of the Nuclear Age," have been lent by the United Kingdom Atomic Energy Authority.

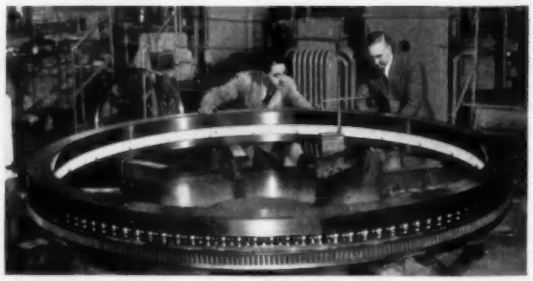
One of the most interesting of the marine exhibits is a full-scale replica of the propelling machinery control room of the "Ashanti" class frigate shown by the Royal Navy. This machinery is provided with automatic and remote control and a small section of the console is operative. The actual control valves can be seen operating both at floor level and by means of a television screen, set in the console.

In this survey we have confined our description to the more outstanding of the thousands of items to be seen at Olympia. In an article of this nature, it is obviously impossible to describe and do justice to all the equipment or even mention all the 500 firms taking part in the Exhibition.

Nuclear Energy

An animated sectional model of a graphite-moderated gas-cooled reactor with one of its associated steam generators is featured on the stand of C. A. Parsons & Co., Ltd. This model illustrates the method of controlling the heat generated in the reactor and the passage of the cooling gas through the steam generator via the gas circulator; the flow of gas is illustrated in the model by coloured lights. The control rods and the charge/discharge machine can also be seen. Another model on this stand represents a 100 MW turbo-alternator with steam conditions suitable for a nuclear generating station. Due to the maximum gas outlet temperature of a reactor, the steam conditions are poor compared to those in a modern thermal station. However, an improvement of the overall steam cycle efficiency can be obtained by the use of a dual-pressure cycle. The steam from the h.p. range expands through the h.p. turbine down to a mixing chamber and, at this point, steam is injected from the l.p. range mixing

Hobson–A.E.R.E. honeycomb unit for the manufacture of isotopes by irradiation in a nuclear reactor



One of two Cooper 8ft diameter ball bearings for the control rod and actuator servicing machines at Berkeley

with the h.p. steam and finally expanding through the l.p. turbine to the condenser. The generator is of the normal hydrogen-cooled design, employing a direct gas-cooled rotor.

The nuclear power plant section of the John Thompson stand is devoted to illustrating the charge/discharge machines for Berkeley. The display has been sectionalised into manufactured assemblies, scale models and diagrammatical presentations. The top 27ft of a 50ft high fuel chute is shown. The pressure vessel in this assembly contains the top portion of a three-channel rotatable magazine and winding gear. A pipe at the top of the assembly allows the machine to be cleared of air and filled with CO_2 before the machine is connected to the reactor vessel. A 4ft diameter magazine, which is also displayed, is an integral part of the charge/discharge machine. It enables a full load of thirteen fuel elements, sufficient for one reactor fuel channel, to be carried in the machine. To estimate the condition of fuel element lifting cable, a magslip transmitter is used to indicate, on the machine control panel, the length of stretch at all times. A second magslip transmitter is employed to indicate the actual position of the grab inside the chute machine.

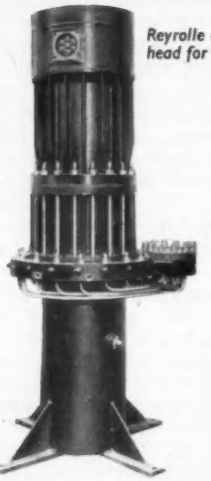
The central feature of the Reyrolle stand is a nuclear reactor control-rod head, as being supplied to Bradwell. A dummy standpipe rig has been arranged to show the raising and lowering equipment in action. The latter is driven by a synchronous motor in the head and is capable of extremely low rotational speeds requiring special low-frequency supplies. The low-frequency generator set with a frequency range between zero and $\frac{1}{2}$ c/s in either direction is also on show.

Among the control instruments and assemblies shown by H. M. Hobson, Ltd., is the Hobson-C.R.L. master/slave manipulator designed for the remote handling of radioactive or toxic materials where shielding is necessary. This lightweight machine has a handling capacity of up to 10 lb per arm. The design incorporates a system of delicate counterbalancing which provides sensitive feel characteristics. Another exhibit on this stand is a Hobson-A.E.R.E. honeycomb unit for the manufacture of isotopes by irradiation in a reactor. The device is fitted through the biological shield of the reactor with the isotope cans in the honeycomb assembly projecting through the graphite reflector. The unit is loaded and unloaded by remote control, the samples being transported to and from the honeycomb assembly by means of CO_2 gas.

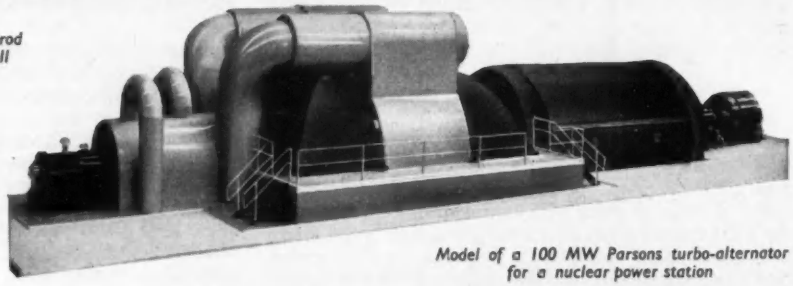
Nuclear power equipment has a prominent place on the Babcock & Wilcox stand. Three displays are devoted to the manufacture of plant for Hinkley Point and components for nuclear power generation and research. Sectional models of a reactor group and a steam raising unit for Hinkley Point are also shown. The nuclear and marine displays both touch on progress in nuclear energy propulsion for ships.

One of two angular contact ball bearings of 90in bore manufactured for the control rod actuator and servicing machines at Berkeley is shown by Cooper Roller Bearings. Each bearing will support 90 tons and has an outside diameter of 8ft 4in. The rolled rings for the races were supplied by Thomas Firth & John Brown, Ltd. Due to the fine manufacturing tolerances, a force of 7 oz applied at the race periphery is sufficient to start and maintain motion.

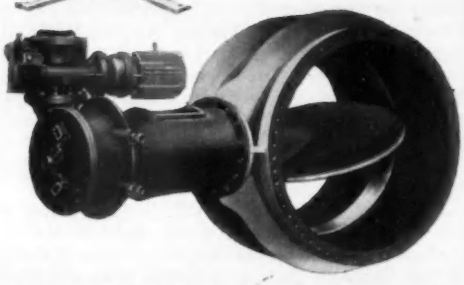
A prominent exhibit on J. Blakeborough's stand is a 60in bore, motor-operated butterfly valve as supplied for



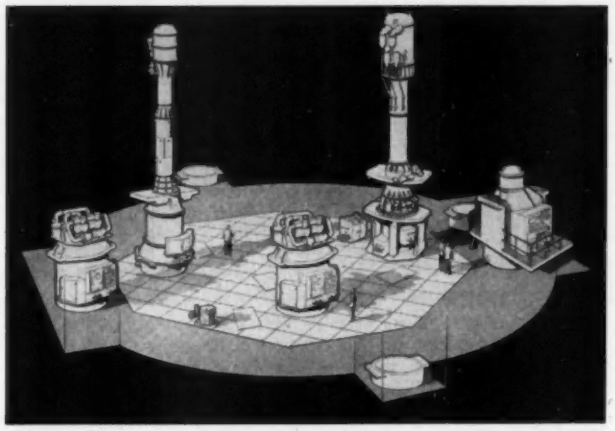
Reyrolle control-rod head for Bradwell



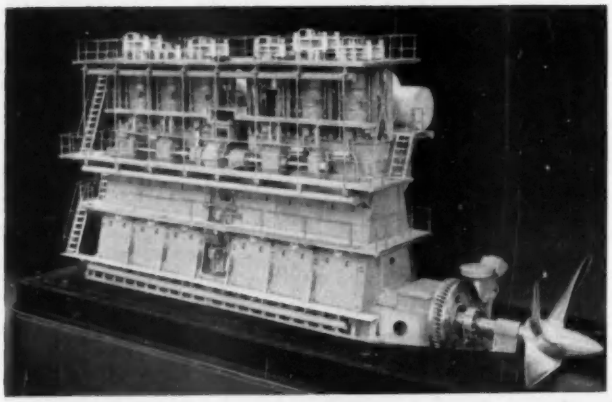
Model of a 100 MW Parsons turbo-alternator for a nuclear power station



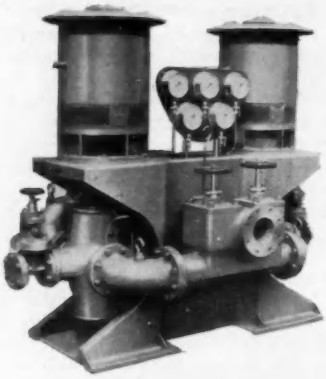
Blakeborough 60in bore motor-operated butterfly valve for main gas duct service for nuclear power stations



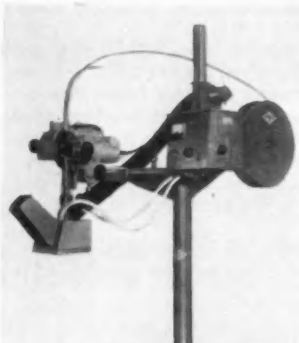
Fuel charge/discharge machinery for Berkeley manufactured by John Thompson

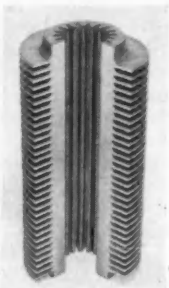


Working model of the Harland & Wolff opposed piston cross-head type marine diesel engine



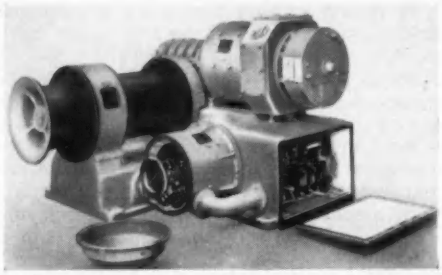
Drysdale forced lubrication pump





Above: Extended surface tube for nuclear power stations (Tubes, Ltd.)

Left: Murex "Muramatic" Mark II welding machine set up for open arc welding



Laurence, Scott 5 ton winch

main gas duct service for atomic reactors. A control rod made of stainless steel with boron inserts is shown by the Talbot Stead Tube Co., Ltd., and Stewarts & Lloyds, Ltd., are showing a control rod standpipe for Hunterston. New developments in extended surface tubes for nuclear power stations and other installations where maximum heat transfer is necessary are being exhibited by Tubes, Ltd.

The Metals Division of I.C.I. is exhibiting new wrought metals such as zirconium, titanium, niobium and vanadium in its nuclear engineering section. Some of the uses of aluminium in the nuclear energy field are being shown by the Northern Aluminium Co. Aluminium has a low neutron absorption cross-section and excellent thermal transfer that make it of particular value in this field.

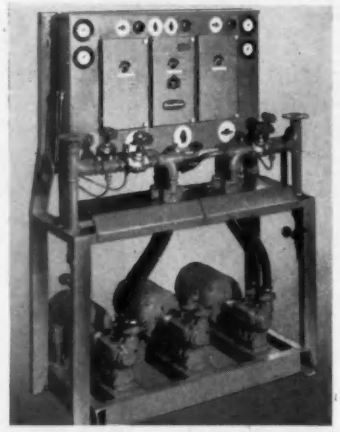
The "Nucleol" range of radiation-resistant lubricants developed for nuclear energy equipment requirements are prominent on the Wakefield-Dick stand.

Marine Equipment

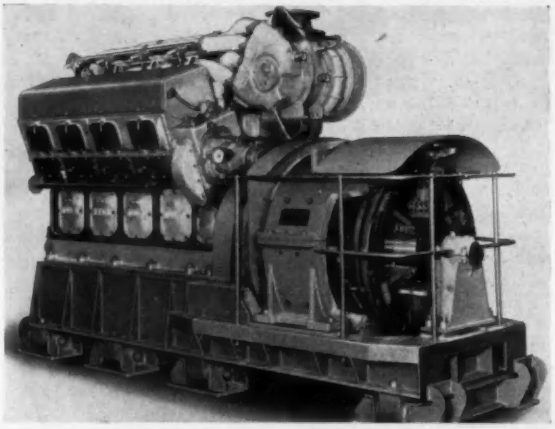
Equipment for marine use is well represented, and the various displays in this section include some of the largest apparatus shown. The exhibits of W. H. Allen, Sons & Co., Ltd., are representative of their range of power generating plant, pumping machinery and electrical equipment for marine and industrial use. The largest unit on the stand is a 330 kW marine auxiliary diesel engine generating set, comprising a pressure-charged six-cylinder, vee-form, 750 r.p.m. 480 h.p. engine directly coupled to a d.c. generator. The engine is of the four-stroke airless-injection, compression ignition type embodying an exhaust-gas turbine-driven centrifugal pressure charger. A medium-pressure forced feed lubricating system is employed, and the fresh water cooling system utilises a common heat exhanger of sufficient capacity to serve three such sets. The compound wound open drip-proof type generator has a single-pedestal Michell bearing, and the magnet yoke, fabricated from low-carbon rolled steel, is split near the horizontal centre line to facilitate fitting and removal of the armature during erection and overhaul. Also shown is a steam turbine rotor for one of the four 1,750 kW auxiliary sets to be installed in the new Orient Line vessel *Oriana* now being built by Vickers-Armstrongs (Shipbuilders), Ltd. There are ten stages, comprising one Curtis two-row wheel and nine Rateau single-row wheels.

The main exhibits of Laurence, Scott & Electromotors, Ltd., are new types of Scott cargo winches. The five ton "Corrector," suitable for a.c. supplies, is fitted with a lightweight a.c./d.c. motor generator which provides a wide speed range by variable voltage control. Other features incorporated include electrical braking, automatic control of maximum speed and automatic stopping on touch-down. All operational switching is carried out on the shunt circuits, eliminating the necessity for main current carrying contactors.

A trailing aluminium anode system for the cathodic protection of a ship's hull against corrosion is shown by the Sunderland Forge & Engineering Co., Ltd. A 150ft length of pure annealed aluminium wire is streamed from the ship's stern, some 30ft being immersed, and connected to the positive terminal of a d.c. supply source, the ship's



Engine room unit pressure set shown by Goodyear Pumps



W. H. Allen 330 kW marine auxiliary generating unit

structure being connected to the negative. The wire acts as an expendable anode, and the approximately 120ft distance between the immersed portion and the hull ensures uniform current distribution. The rudder stock is connected to the hull by a flexible cable, and the propeller is " earthed " through a slip-ring and brush on the shaft. The motor generator set, normally mounted in the steering gear compartment, has an output of 300 A at 30 V and the anode wire is supplied in 160 lb coils which last for between one and three months, dependent upon the protective current required. Silver/silver-chloride hull-mounted reference cells are fitted with sliding valves and packing glands to permit inspection without dry-docking the vessel.

Goodyear Pumps, Ltd., a member of the Holman group, are showing for the first time at any exhibition an engine room unit pressure set which provides fresh and salt water supplies for all size ships. The unit, which can handle from 2½ to 7½ tons of water per hour, comprises three positive displacement pumps, of either bronze or Meehanite construction, coupled to English Electric drip-proof motors of 1 h.p. rating to supply 2½ tons of water per hour or 2 h.p. for 7½ tons per hour. Three Laurence, Scott starters are mounted on a panel with two Teddington pressure switches, running lights, selector switches, isolators and pressure and vacuum gauges for each service.

The English Electric Co., Ltd., exhibit is part of a comprehensive a.c. auxiliary installation for five cargo liners being built by Harland & Wolff for the British India Steam Navigation Co., Ltd. It comprises an exhaust turbo-charged diesel engine directly coupled to a 350 kW, 440 V, three-phase, 60 c/s alternator; a main a.c. distribution switchboard with OB2 type air-break switchgear for controlling the supply from four such sets; a " Superform " marine sub-switchboard, one of nine being supplied for each vessel, in which the circuits are switched by chassis-mounted fuse switch units controlled from the front by retractable operating handles; three fuse distribution boxes; and a range of T type cartridge fuse links approved by Lloyd's Register of Shipping.

On the Harland & Wolff, Ltd., stand exhibits include a model of the 45,000 ton passenger liner *Canberra* being built at Belfast for the Peninsular & Oriental Steam Navigation Co., the largest liner built in the United Kingdom since the war, a horizontal Cooper Bessemer air compressor of a type capable of delivering air at pressures up to 15,000 p.s.i., and a salient pole marine alternator rated at 75 kW at 450 r.p.m. Also shown is a working model of a large diesel ship propulsion engine of the two-cycle single acting opposed piston crosshead type.

Among the exhibits on the Sperry Gyroscope Co., Ltd., stand is a flaw and corrosion detector, manufactured under licence from I.C.I., Ltd., which is shown working on a representation of a steam condenser. The equipment employs eddy current principles to detect corrosion, thinning, flaws and other abnormalities in non-ferrous materials, in particular copper and alloy tubes of the type used in marine or power station condensers and heat exchangers. A second working display illustrates automatic machine control by the application of electro-hydraulic servo techniques. Part of a ship's wheelhouse is represented on the upper level of this stand, in which are installed examples of new marine gyro-compasses and gyro-electric and gyro-hydraulic steering control equipment.

A forced lubrication pump in which two vertical gear pumps, one on standby duty, are mounted on a common stool and are connected by all necessary pipework and valves to form a packaged unit, is shown by Drysdale & Co., Ltd. If the pressure in the working pump falls, the standby pump is automatically started by a pressure switch connected in the starter circuit. These sets are available in 4 to 8in bore sizes with capacities up to 650 gal per min and pressures up to 100 p.s.i. and suction lifts of 10ft. Also shown is a 32in bore axial flow horizontal pump with a 16,700 gal per min capacity of sea water for main condenser cooling.

Welding

Nearly 40 firms are represented in the welding section of this Exhibition and the majority include some form of electrically-operated equipment on their stands. Although there are few outstanding new developments on show, there appears to be a slight trend towards making more welding operations automatic. Automatic equipment for the welding of mild steels and stainless steels is being shown by Murex and demonstrations of their " Muramatic " apparatus are being given on their stand. The welding head of this equipment has been designed for use with either submerged-arc or open-arc processes using either a.c. or d.c. supply and with welding currents up to 1,200 A. A control panel with current, voltage and various " stop," " start " and speed controls is attached to the welding head. When used on the open-arc process,

the head can be fitted with a combined arc-shield and fume-extractor head and fan. For the submerged-arc process, a flux hopper is incorporated instead of the hood. Fluxes and wires for automatic welding are also shown on this stand as well as the established range of Murex welding transformers.

A new self-propelled twin-fillet automatic welding machine using the Fusarc/CO_2 process is exhibited by Quasi-Arc. The machine, which is fitted with two welding heads, can make two fillet welds simultaneously at speeds of 15-26in/min. Features of the machine are its self-guiding action and the ease of manœuvring and setting up the heads.

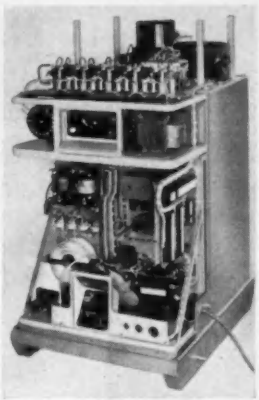
The main feature of the British Oxygen Co.'s stand is a one-tenth scale model of a computer controlled gas-cutting machine. The machine, which is designed to cut the complicated hull curves required by shipbuilders, consists of a traverse boom carrying a cutting head on each side of a fixed central track. Hydraulic servo motors move the carriage along the track and the cutting heads on the boom. The motors are controlled by a Ferranti magnetic tape mechanism with rotary feedback devices. The heads move in opposition to one another so that both port and starboard plates are cut simultaneously. The magnetic tape is produced by means of a "Pegasus" computer in conjunction with a digital differential analyser after a planing sheet has been prepared from the drawing.

A new development shown by the Arc Manufacturing Co. is a contour-following device by which welded joints of irregular profile can be made without repositioning the work. The path of the welding head to which an argon-arc torch is fitted is governed by a fixed template which corresponds with the contour of the joint to be welded. Also exhibited is a new range of selenium-oxide welding rectifiers, primarily designed for the tungsten inert gas welding of stainless steel, "Nimonic," titanium, copper, nickel, etc. The units can also be used with coated electrodes for welding mild and low alloy steels, bronze and aluminium, and are oil cooled. This ensures freedom from contamination or disturbance of the atmosphere by cooling fans. These units, of varying capacities from 40 to 250 A, are rated for continuous welding. A number of the welding operations involved are effected semi-automatically by remote control.

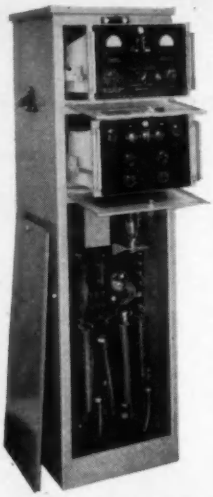
A new spot-welding transformer gun, the "Plate-Master," designed for welding steel plates from $\frac{1}{8}$in + $\frac{1}{8}$in to $\frac{3}{16}$in + $\frac{3}{16}$in is shown by the Aro Machinery Co. It is pneumatically operated and weld pressure is supplied by a double-acting air cylinder which is controlled by two air pilot valves and a solenoid. The unit is controlled by a timer-contactor equipped with adjustable weld-power, weld-time and weld-forge controls, twin-earth monitoring safety circuit and the Aro thermic energy control system.

Fuller Electric are demonstrating an automatically controlled flash welder built by Asea Svetsmaskiner AB of Stockholm. This machine is designed for welding tubular elements with internal automatic flash removal, and is equipped with special auxiliary control equipment for the welding of chrome-molybdenum and stainless steel tubes, using inert gases or gas mixtures instead of air. The "Autopac" welding head shown by Rockweld, Ltd., incorporates sensitive automatic arc voltage control, while the "Hivolt" surge injector argon arc welding unit being demonstrated by Saturn Industrial Gases, Ltd., has automatic control of both gas and arc.

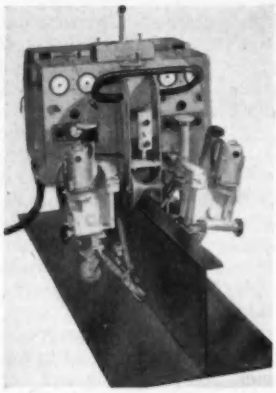
Many new resistance welding machines are displayed by Sciaky with varied examples of assemblies welded by their three-phase system and their three-phase "Modu-



Arc Manufacturing's "Actarc" 100 A oil-cooled welding rectifier

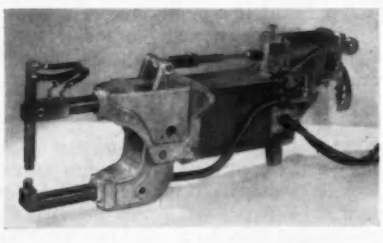


British Federal fully synchronous control panel for resistance welding, having dekatron timing, phase shift heat control with an added constant current or constant voltage control



Lincoln twin-head automatic submerged arc tractor unit

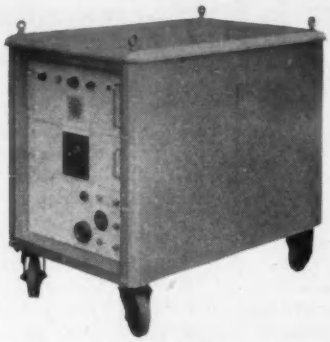
Above: Solus Schall Junior crack detector of ferro-magnetic specimens



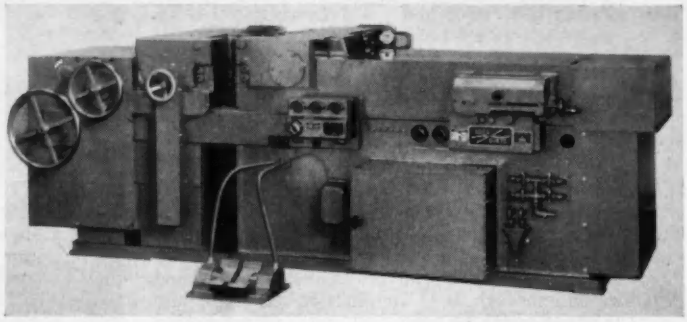
Left: A.R.O. spot-welding gun type 510 'Plate-Master'

Wave" system. The three-phase system offers many advantages over the single-phase system including high power factor, balanced load, good secondary wave slope, extended electrode life and a wider application in weldable materials.

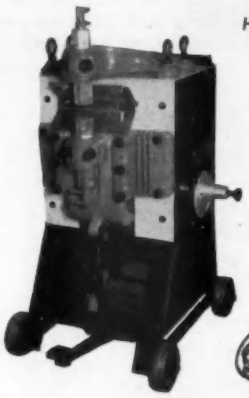
A welding machine especially designed for plastic-coated sheet steel is being shown by Hirst Electronic, Ltd. This firm is also exhibiting a new resistance welding current meter with six ranges covering 500 to 10,000 A. A new twin-head tractor for submerged arc welding especially designed to speed production of fillet welding is shown on the Lincoln Electric Co. stand. The independent welding heads can each be used as a single unit or as a combination to produce twin welds on either side of a stiffener or similar application. The tractor is



Saturn "Hivolt" surge injector argon-arc welding unit

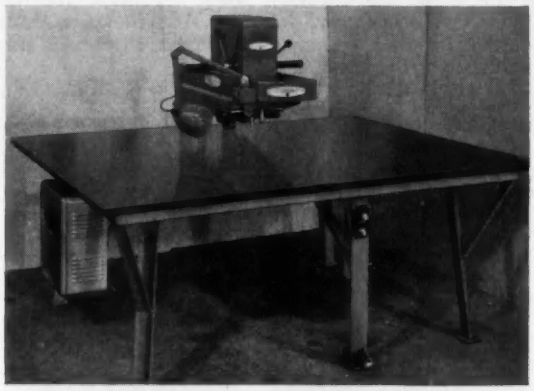


Asea Svetsmaskiner AB automatic flash welder shown by Fuller Electric



Holden & Hunt's single-head heavy-duty rivet heater

Ultrasonoscope flaw detector



Hirst Electronic welding machine designed for plastic coated sheet steel

self-guiding and is adjustable for varying stiffener heights from 4in to 24in.

Lincoln are also showing and demonstrating their new "Arcmaker" silicon rectifier-transformer unit. It has an open circuit voltage of 90 V with a wide current range from 60 to 300 A in two stages. The most outstanding exhibit on the English Electric stand is the LWAD 600 portable welding transformer-rectifier. It offers the choice of two outputs, namely, 95-200 A d.c. or 116-624 A a.c. The unit employs silicon rectifiers and is oil cooled.

Exemplifying a new series in the Birlec range of mesh-belt conveyor continuous furnaces for annealing and brazing, the centre-piece of the stand is a humpback furnace. Rated at 20 kW and with a conveyor belt 6in wide to carry the work continuously through the treatment process, this furnace has been developed for the bright annealing and brazing of a wide range of components in stainless steel and similar materials. An essential requirement for the treatment of stainless and heat-resisting alloys is a protective atmosphere of utmost purity. Either hydrogen or a hydrogen-nitrogen mixture is generally used and, to prevent contamination and to reduce the gas consumption to the minimum, the furnace is provided with a continuous, internal gas-tight muffle with sloping inlet and outlet tunnels. The heating chamber is fitted with silicon carbide elements which are easily removable and enable working temperatures up to 1,200 deg C to be attained. For exhibition purposes, the furnace is equipped with a standard Birlec "Exothermic Atmosphere Generator" of a recent and simplified design suitable for the smaller range of furnaces.

A new dynamic balancing machine is being shown for the first time by W. & T. Avery. It is suitable for rotors which cannot be driven by means of an end drive. The machine consists of two main units; one unit carries the V-bearings for supporting the rotor, the rotor belt driving gear and a bracket carrying a photo-electric phasing pick-up and the other unit contains electrical indicating instruments and amplifiers.

Solus-Schall are showing a new small magnetisation unit for crack detection of ferro-magnetic specimens by means of magnetic ink. Various other apparatus for non-destructive testing by X-rays, ultrasonics and eddy currents are also exhibited on this stand. A new ultrasonic flaw detector is being shown by Ultrasonoscope. It has fast time-base speeds and high trace brightness combined with a rectified or unrectified trace display to enable a comprehensive study of flaw echo shape. It has an operational frequency range of ½ Mc/s to 10 Mc/s and a maximum depth range of 20ft in steel.

At the request of the Admiralty, a number of electrical manufacturers collaborated to produce the design of a magnetic amplifier type of voltage regulator suitable for a wide range of 60 c/s generators. A prototype model is being shown by the British Thomson-Houston Co. The General Electric Co. are demonstrating their "Accurex" static excitation system which was described in the *Electrical Review* of 4th July, 1958.

George Ellison are showing their new vertically-isolated 11 kV, 250 MVA oil circuit-breaker units. The contact assembly has renewable arc contacts and side blast arc control devices and the 1,200 A air-insulated busbars are

covered with Tufnol insulation. This firm is also showing a new oil switch with a breaking capacity of 400 A and a making capacity of 250 MVA. It is manually operated by charging and releasing a spring with one movement of the handle. This oil switch can be used to control a ring main supply to the circuit-breaker previously described.

A large exhibit on the Metropolitan-Vickers stand is a 3,000 h.p., 3,580 r.p.m. boiler feed pump motor. It has a low starting current with sufficient starting torque to accelerate quickly from rest to full speed. For ventilation, air is drawn into the machine at both ends by two propeller type fans. This air is directed over the end windings and through axial air ducts in the stator and over the periphery of the rotor core. It is then deflected through radial ducts in the stator core and finally discharged through a large aperture in the top of the yoke frame. The h.p. cylinder casing and rotor for the 12,500/13,750 s.h.p. two-cylinder geared propulsion steam turbine for the new Eagle oil tanker *San Conrado* is also exhibited on this stand.

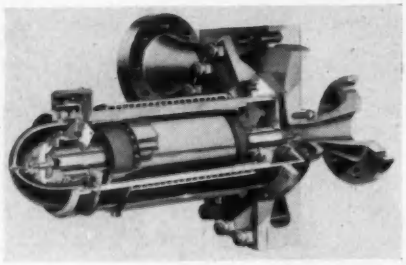
A sectioned scale model of one of the High Marnham power station boiler units is displayed by International Combustion. This firm is also showing one of the manifolds of a 200 MW unit for High Marnham.

Prime Movers

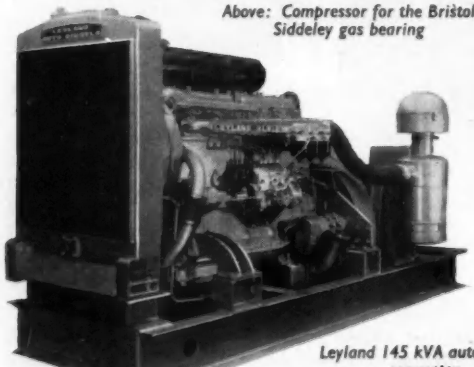
Many new power units are being exhibited this year. One of the "Vega" range of vee-form air-cooled diesel engines, available from 200 to 466 h.p. and claimed to be the largest air-cooled power unit in commercial production, is being exhibited by Davey Paxman & Co., Ltd., an associate of Ruston & Hornsby, Ltd. Also shown is the Ruston 6 ATC, a six-cylinder pressure charged intercooled engine from the new AT range which covers from 705 to 1,685 h.p. in five sizes, with five to nine cylinders, and a Paxman 12-cylinder "Ventura," a range—500 to 1,870 h.p.—of engines having a high power/weight ratio.

A wide range of diesel engines from 70 to 275 h.p. for industrial, earth moving and public works plant and machinery, including fire pumps, generating sets and marine units, are among the exhibits displayed by Leyland Motors, Ltd., a large number of them fitted with torque convertor drives. The auto-diesel generator shown

Ellison 11 kV switchboard

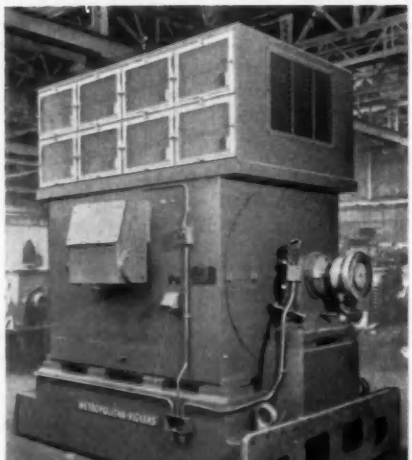


Above: Compressor for the Bristol Siddeley gas bearing



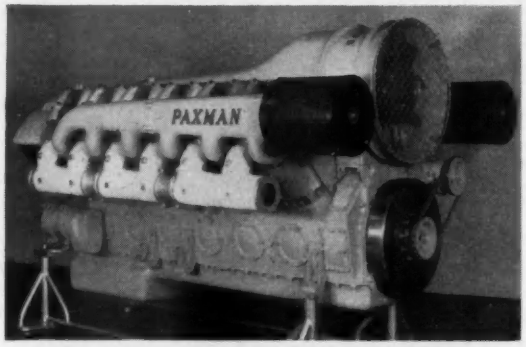
Leyland 145 kVA auto-diesel generator

Metropolitan-Vickers HTAS boiler feed pump motor



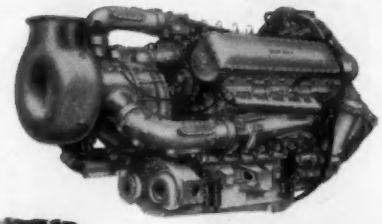
Hartridge heavy duty fuel pump test bench

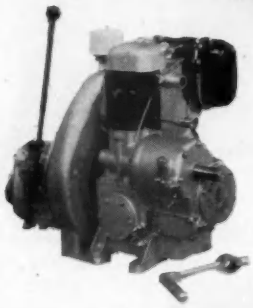
Crankcase oil mist detector shown by Graviners



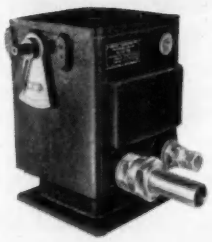
A 466 b.h.p. air cooled diesel engine—the Paxman "Vega"

Turbo-charged Napier "Deltic 18"





Enfield high-speed air-cooled lightweight marine diesel engine



Ardleigh type 500 diesel generator governor actuator unit

incorporates a six-cylinder engine producing 176 h.p. at 1,500 r.p.m. on a 12-hour rating, or at 1,800 r.p.m. for a 60 c/s output. It is fitted with 24 V electric starting equipment comprising an axial type starter motor, belt driven dynamo with cut-out and voltage control unit, "start" solenoid switch, "start" pushbutton, ammeter and battery. A flexible "Layrub" coupling carries the drive to the "Magnicon" self-regulating alternator which is rated at 145 kVA at 230 or 400 V, 50 or 60 c/s.

Among the exhibits of the Hawker-Siddeley Group is a comparatively new form of power generator, a free piston gasifier turbine installation incorporating two 1,250 h.p. National GS34 free piston gasifiers supplying power gas to a Hawker-Siddeley Brush series 200 gas expansion turbine. This is shown by National Free Piston Power, Ltd., and is manufactured by the National Gas & Oil Engine Co., Ltd., and the Brush Electrical Engineering Co., Ltd. Other exhibits by members of the group range from Petters' high-speed lightweight air-cooled diesel engines, to a Bryce Berger pneumatic-hydraulic engine starter system.

The turbo-charged "Deltic 18," publicly exhibited for the first time on the stand of D. Napier & Sons, Ltd., has a maximum output of 3,100 h.p. and a continuous rating of 2,400 h.p. at crankshaft speeds of 2,100 and 1,800 r.p.m. respectively. At continuous power, the fuel consumption is 0·417 lb/h.p./hr and the oil consumption is nine pints per hour. Also shown on this stand are "Spraymat" surface heaters which consist of conductor elements, applied by flame spraying, between insulation layers of a thermo-setting synthetic resin applied as a liquid. The heaters are normally between 0·030 and 0·070in thick, and the conductor element covers up to 95 per cent of the total area. Steady working temperatures of 150 deg C may be maintained indefinitely in still air, and heaters can be designed with a heat dissipation up to 100 W per sq in.

In addition to a range of high-speed diesel engines manufactured under licence from Maybach Motorenbau G.m.b.H. and "Beaver" recirculating ball screws and splines, Bristol Siddeley Engines, Ltd., are exhibiting gas bearings for supporting rotating shafts in applications where contamination from lubricants cannot be tolerated. Since the bearing is supported on a film of gas, there is no metal-to-metal contact under operating conditions, reducing maintenance, and the load carrying capacity increases with speed, temperature and pressure. On the second Bristol Siddeley stand is a sectioned "Proteus" gas turbine marine engine, with a continuous rating of 2,800 s.h.p. and a half-hour rating of 3,500 s.h.p., and a model of a 3 MW turbo-generator comprising a free power gas turbine, without heat exchanger and running on gas oil, coupled by a short cardan shaft to a 3,200 kVA alternator. Since the turbine driving the alternator rotates independently of the compressor rotor, the power required for starting is negligible as there is no necessity to rotate the alternator when starting.

Being shown for the first time at this Exhibition by Enfield Industrial Engines, Ltd., is a marine 350 c.c. high-speed lightweight air-cooled diesel engine, producing over 4 s.h.p. at 3,000 r.p.m. Equipped with reverse gear giving full power ahead and astern, it weighs only 250 lb. Also shown is a representative selection of other Enfield engines covering a power range of 3 to 22 h.p.

Auxiliary Equipment

Among the various manufacturers of diesel engine accessories and auxiliary equipment are Leslie Hartridge, Ltd., who show fuel pump test benches, a pump calibrator, and injection nozzle maintenance equipment, in addition to an exhaust smoke density indicator.

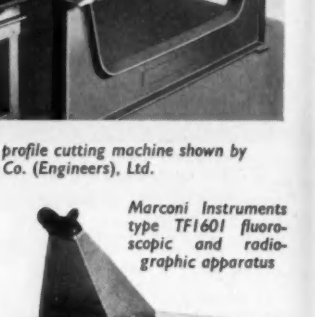
The Graviner Manufacturing Co., Ltd., are exhibiting industrial explosion protection and suppression equipment, including a photo-electric detector for oil mist concentrations in diesel engines which, if allowed to persist, might cause a crankcase explosion. A new high sensitivity detector, which functions on a small degree of abnormal temperature rise on any of the main bearing and working surfaces within a crankcase, operates by balancing the outputs from two photo-electric cells energised by beams of light passing through tubes containing oil mist drawn continuously from different crankcase chambers. When the oil mist columns are of equal density no current flows, but if the mist density increases in one crankcase chamber the current produced by the resultant unbalance energises an alarm relay.

The type 500 governor shown by Ardleigh Engineering, Ltd., has been developed to give accurate control of prime movers for a.c. generating sets where frequency variation under varying load conditions must be kept to the minimum. The equipment, which comprises a control panel, amplifier, pump unit and fuel rack actuator, measures the electrical load and adjusts the throttle setting accordingly. Changes in load cause throttle changes to take place before the engine speed changes,

Fluidrive double circuit scoop-trim fluid coupling

" Hancomatic " oxygen profile cutting machine shown by Hancock & Co. (Engineers), Ltd.

Above: Vertical-mounted Kopp variable speed gear unit on the Allspeeds, Ltd., stand



Marconi Instruments type TF1601 fluoroscopic and radiographic apparatus

Type L2000 air compressor shown by Broom & Wade

and a second speed error signal prevents any speed drift occurring.

Air Compressors and Fans

Among the stationary compressors shown by Broom & Wade, Ltd., is a new two-stage double-acting unit, the type L2000, which can deliver 2,200 cu ft of free air per minute at a pressure of 100 p.s.i. The standard unit employs a 415 h.p. salient pole, synchronous flywheel type motor with its rotor mounted directly on the compressor crankshaft, the stator standing on its own soleplate. Also shown are a range of portable and stationary pneumatic power units.

The largest item shown by the Consolidated Pneumatic Tool Co., Ltd., is one of their class FE compressors, seen at this Exhibition for the first time. By varying the sizes of cylinders and the number of crank throws, this range of horizontal, double-acting balanced opposed compressors can be adapted for widely varying applications up to 3,000 p.s.i. or 5,000 c.f.m. Additions to their lightweight range of pneumatic tools, and a fast medium-weight rock drill for tunnelling are also shown, with the full range of " Hicycle " high-frequency electric tools. Reavell & Co., Ltd., are showing a representative range of their compressors, exhausters and accessories including their RM type pneumatic pressure switches for controlling electrically driven air compressors. Independent adjustment of the pressures at which the compressor motor is started and stopped can be made, and no relays are required, the tungsten switch contacts being capable of carrying the control circuit current of contactor type starters at up to 550 V a.c. or d.c.

Exhibited by Keith Blackman, Ltd., are two examples of their new " Aristocrat " centrifugal fans, for heating, air conditioning and general ventilation applications, which have an initial capacity range up to 9,000 c.f.m. at 3·5in s.w.g. Representative of their larger fans is a 70in impeller with backward bladed aerofoil section blades, providing efficiencies up to 90 per cent. Most of the directly driven fans shown on this stand include motors manufactured by the company.

Gears and Power Transmission

Exhibits in this category always form an important part of the Exhibition and some new items are to be seen, with a large amount of improved and modified equipment. A comprehensive range of clutches and couplings is being shown by Twiflex Couplings, Ltd., including for the first time a range of industrial disc brake clutches, arranged for pneumatic, hydraulic, electromechanical or mechanical operation. The use of an automatic clutch coupling where the drive is an electric motor is shown on one of the three working models on the stand, allowing the drive to be engaged at the most advantageous point on the torque/speed curve of the motor, permitting it to start under no load and reducing the duration of the high starting current. Also shown is the company's free overrun coupling which enables the drive to transmit torques in one direction, and the system to overspeed, due to the load or an alternative power unit operating, without transmitting torque back to the primary driving unit.

One of the main exhibits on the Fluidrive Engineering Co., Ltd., stand is a Vulcan-Sinclair double-circuit scoop-trim fluid coupling for high power infinitely-variable high-speed drives. Five sizes have been developed, transmitting from 3,000 to 20,000 h.p. at 3,000 r.p.m.,

that illustrated being one of the sixteen units for driving the 3,000 h.p. B.T.H. axial blowers at Berkeley nuclear power station.

Allspeeds, Ltd., are again exhibiting their range of Kopp variable-speed gears which are available from $\frac{1}{33}$ h.p. to 15 h.p. All units have a stepless speed variation of 9:1 and transmit constant h.p. throughout this speed range. A new unit is being shown, designed for vertical mounting and fitted with a built-in oil sump and pumped lubrication system.

Shown by Self Changing Gears, Ltd., is a fully automatic control for rail traction, which selects gears automatically following a pattern giving optimum vehicle performance. Tractor and marine gearboxes are also shown, and demonstrations are given in which the pressure build-up in a cylinder and the torque strain in a band brake shaft are presented and recorded on a new range of electronic recording equipment.

A large variety of pneumatic power cylinders and electromagnetic valves are shown by the Baldwin Instrument Co., Ltd., many being quarter-sectioned to show the method of construction. The valves, of the glandless poppet type, have a maximum power consumption of 6 W.

A dual-carriage oxygen profiling machine is shown on the stand of Hancock & Co. (Engineers), Ltd. A new type of solenoid gas control valve is fitted which shuts off the cutting oxygen flow on completion of the cut, avoiding damage to the profile as it falls from the parent plate. Automatic pushbutton burner ignition is optionally available.

Among the X-ray equipment exhibited by Marconi Instruments, Ltd., is a mobile fluoroscope and radiographic cabinet, the type TF1601, allowing direct visual examination of objects. The equipment, which has an output of 10 kV at 10 mA with water cooling, is housed in a cabinet lead lined where necessary to protect the operator against direct and scattered radiation.

Lighting Fittings Manufacturers

Functions of Trade Associations

SIR KEITH JOSEPH, Bt., M.P., was the principal guest at the annual luncheon of the Electric Light Fittings Association held at the Tallow Chandlers' Hall, London, E.C., on 8th April. Mr. D. L. Tabraham, president of the Association, was in the chair. In proposing the toast of the Association Sir Keith Joseph said he thought that the Budget proposals would be generally considered satisfactory, particularly the investment allowances. As a contractor he was very much concerned with the lighting of buildings. He found that the occupants of large modern buildings were in favour of lighter types of fittings.

Industry was of a five-fold character consisting of labour, shareholders, management, consumers and inventors. Without the last we would lose the export markets of the world. Average earnings in this country were still rising and this should revolutionise the demand for all products, including lighting fittings. Russia was giving much attention to electronic control and automation. She would beat us in export markets if we did not keep ahead by pursuing research. Funds for defence research were unlimited and although from this there came by-products for civil use the Government would have to consider devoting more funds to civil research, even if it did not produce immediate results. Sir Joseph said that he hoped investigation of the Association's agreements by the Restrictive Practices Court would leave the Association untouched. He also hoped that one day a European Free Trade Area would be established. This would probably mean intense competition but would open up a tremendous market.

In the course of his reply to the toast Mr. Tabraham said that Sir Keith Joseph's emphasis on research was very welcome. He congratulated Mr. Leslie Gamage on his appointment as president of the British Electrical and Allied Manufacturers' Association and Mr. W. J. Bird as chairman of the Domestic Appliances Division of the B.E.A.M.A. It was rather paradoxical that in the jubilee year of the Illuminating Engineering Society the industry should be called upon to defend its trade practices. Since 1909 this country had led the world in many fields of lighting. It was no part of the Association's policy to cling to outmoded ideas, but it would adhere to proved methods which could be adapted to modern conditions.

They hoped that the industry's prosperity would continue although their customers were becoming very keen buyers. The industry had always been highly competitive and had succeeded in building up business in all

1. Mr. D. L. Tabraham (president) responding to the toast proposed by Sir Keith Joseph who is on his right. 2. Mr. T. S. Jones proposing the toast of the guests; on his right is Mr. L. C. Penwill, on his left Mr. A. E. Iliffe. 3. Mr. S. F. Steward replies; Mr. T. W. Heather is on his left

markets of the world. While manufacturers were called upon to increase production, distributing associations must also play their part in increasing the demand. Harmony must exist between manufacturers and distributors and they hoped to defend their agreements successfully before the Restrictive Practices Court. Mr. Tabraham referred to the work of the E.L.F.A. technical committees, the Association's statistical service, and its consultation with other bodies which needed its services. He thanked Mr. J. H. Campion, the secretary, and his staff for their help, particularly in connection with the Restrictive Trade Practices Act. Mr. Tabraham said that whether there was a common trading code or individual members pursued their own policies the spirit of the Association would never die. While sales must be increased to the utmost, the industry would fail to meet its opportunities if it sacrificed its profits and moved away from good quality and design.

Mr. T. S. Jones proposed the health of the guests, making particular reference to the presence of Mr. C. C. Smith, president of the I.E.S., and Mr. G. F. Cole, its secretary; Messrs. F. Winstanley, A. E. Iliffe and C. Hughes, past-presidents of the E.L.F.A.; and the former director, Mr. Felix Rogers.

The response to the toast was by Mr. S. F. Steward, C.B.E., director-designate of the B.E.A.M.A., who said that by co-operation the members of the E.L.F.A. had brought about remarkable developments in lighting, which was still the corner-stone of the electricity supply industry. There was much false economy in the matter of lighting and there was scope for raising the standard in many factories and homes—even electrical engineers' homes. One of the principal functions of trade associations was to bring people together. He had seen the operations of these associations both from within a Government Department and from the viewpoint of an Electricity Board, and he was sure that the associations would continue and play an important part in national affairs. It was their duty to see that the distributors and customers had a fair deal.

Annual Report

In his report for 1958 Mr. Tabraham (president) said that in addition to a full programme of normal work the Association had been engaged in preparing its case for the Restrictive Practices Court. E.L.F.A. was informed last April that its discount structure and related conditions would be examined by the Court, probably towards the end of 1959.

Sales of lighting equipment had continued to rise in spite of the significant reduction of new industrial building, and members could look forward to a steadily increasing demand for their products. The members had always competed vigorously with one another and with other manufacturers at home and abroad, and they would continue to do so. The membership, however, consisted primarily of manufacturers who believed in the value of an organised trading structure as a stabilising influence throughout the trade, and were prepared to put their beliefs into practice. They remain convinced that to be of maximum value to the community competition must be guided by principles which not only assured the user of increasing value for money, but also protected the legitimate margins of the distributor and permitted investment in research, design and production.

They considered it their duty, therefore, to continue to operate their trading codes and to defend stabilised trading. The main feature of the trading codes was a simple discount structure for normal trading and normal quantities, based on the Electrical Fair Trading Policy, but each member retained complete freedom to fix his own list prices and for very large installations competition was entirely free.

Many non-associated manufacturers also supported these principles. While E.L.F.A. had accepted the heavy burden of preparing and conducting the case in the Restrictive Practices Court, the industry should appreciate that, given a favourable verdict by the Court, the survival of stabilised trading would depend, in the long run, on the full and practical support of everyone in every section of the industry who believed in it.

E.L.F.A. believed in seeking the views of the distributors' associations to ensure a sensible and equitable trading policy. The Association acknowledged the friendly and helpful way in which the E.W.F., N.E.C.T.A. and E.C.A. of Scotland had expressed their views at joint meetings.

Much of the work of the Technical Committee and its sub-committees was devoted to standardisation. E.L.F.A. representatives served on over 50 B.S.I. Committees dealing with fittings, auxiliary gear, lamps and related equipment.

A special committee dealt with the collection and study of data about lamp dimensions and performance and it met from time to time a corresponding committee of the Electric Lamp Industry Council. As usual, E.L.F.A. representatives had taken a prominent part in international meetings of the I.E.C. and C.E.E. with a view to establishing internationally agreed standards and specifications.

The Association always endeavoured to help members to increase their export business. Information about export opportunities and statistics of exports to each country in the world was frequently circulated; the export figures for fittings in the first nine months of 1958 exceeded those for the same period in 1957 by 36 per cent.

Mr. Tabraham has been elected president of the Association for a second year.

Electrical Research

Sphere Gap Voltage.—Report Ref. L/T369 " Analysis of the I.E.C. and A.I.E.E. Sphere Gap Voltage Measurement Standards " by A. Morris Thomas (price 10s 6d), makes special reference to the existing British and U.S. calibrations and the work of the I.E.C. Committee. The procedure originally used for checking the internal consistency of the calibrations is criticised and a new formula is described which permits a straight line extrapolation of the sphere gap sparkover voltages to uniform field sparkover voltages. It is suggested that the use of this formula will be of assistance in deriving a more accurate table of calibrations when a few points have been redetermined with the greatest possible accuracy.

Waveform Generator. — Forcing-function generators are often necessary to provide input waveforms for analogue computers. Although the generation of arbitrary waveforms representing experimental results requires complex equipment, many functions which are frequently used may be generated by simple circuits. One such function is the double-exponential waveform used in the study of lightning surges and the circuit for a suitable generator is described in report Ref. V/T136 " A Double-Exponential Waveform Generator for Model Networks " by P. G. Kendall (price 7s 6d).

Circuits for producing such surges for full-scale testing have already been described in report Ref. S/T35. In these circuits the peak voltage of the surge is required, for efficiency, to approach closely the initial voltage of the impulse generator. In shaping low-voltage surges for use with a transient network analyser, however, there is no difficulty in obtaining sufficient voltage amplitude and the wave-shaping components may therefore be selected in such a way that the calculation of their values is simplified.

Copies of these reports are available at the prices indicated from the publications sales department of the Association at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

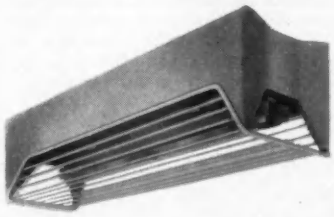
Factory Equipment Exhibition

THE Factory Equipment Exhibition now being held at Earls Court, London, is of two-fold value; not only does it show the way to improvements in efficiency in existing works but it also assists directly in the planning of new plant and buildings. Last week's Budget announcement of a general restoration of investment allowances for new plant and machinery will no doubt provide a stimulus in this direction.

The Exhibition, opened by Lord Mills, Minister of Power, is the most comprehensive display of its kind and has been extended from six to ten days, closing today (Friday) at 4 p.m. Over 300 exhibitors are taking part and the theme, "Efficiency and Expansion," is reflected in the wide variety of plant and equipment assembled. Electrical apparatus on display covers such fields as heating and ventilating plant, fuel economy equipment, instruments for automatic control, trucks, clocks, fire alarm systems, and fire detection equipment.

The stand of the Minerva Detector Co., Ltd., contains several exhibits showing applications of the company's system of fire detection, including the new 91C control unit. It has been designed to give an immediate warning of any outbreak of fire in unattended electronic equipment such as life test racks, experimental electrical gear, prototype equipment, etc., and is so arranged that when fire is detected the power supplies to the equipment concerned are cut off, usually resulting in the fire going out. At the same time, an alarm is given by bell or other means.

Associated Fire Alarms, Ltd., is showing for the first time its new "Fidela" automatic fire detector. The

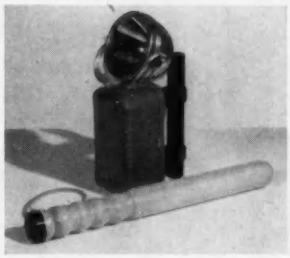


"Fidela" automatic fire detector (Associated Fire Alarms, Ltd.)

instrument measures only 7¼in by 2¼in by 2⅜in and is contained in a moulded glass fibre polyester housing, available in a selection of colours. The contacts are contained in a sealed compartment giving adequate protection from moisture or corrosive vapours.

Several companies are exhibiting ventilation and air conditioning apparatus. Colt Ventilation, Ltd., has a representative range and its ventilation systems can also include fire protection and warning equipment. The Greenwood's & Airvac Ventilating Co., Ltd., is showing both natural and powered ventilation units and, on a separate section of its stand, a typical layout of underfloor and skirting ducting with a variety of accessories.

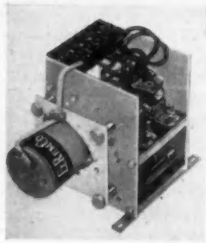
Exhibited for the first time by Multitone Electric Co., Ltd., manufacturers of the "Personal Call" staff location system, is a new model which enables instructions to be passed to drivers of fork lift trucks, trolleys and similar vehicles in factories. It consists of a small transistorised receiver, incorporating a loudspeaker, and has been designed for attachment to these vehicles. It can be powered by a small battery or directly connected to the vehicle battery. Also on this stand is an electronic truncheon designed to be carried by night watchmen or guards. It incorporates a 6 V accumulator, oscillator and a ferrite rod aerial. When a button is pressed sufficient energy is induced in a wire loop, around the total area of the building, to operate the relay of an automatic alarm or "999" call device. Similar equipment is also shown incorporated in a hand-lamp.



Multitone electronic truncheon and torch

An individual "paging" system, the "Mira" tele-tracer, with up to 360 individual channels, is shown by Cass Electronics, Ltd.

A time and sound system shown by the Magneta Time Co., Ltd., enables all clocks, time recorders and audible signals needed by a factory to be pre-set to a programme and activated by operation of a master clock. In addition to keeping a time check of staff movements, the system provides internal communication and information, with predetermined signals for meal and other breaks; for operational change-overs; for fire alarms and other warnings; and even "Music-while-you-work." The Electrical Remote Control Co. has on view a wide range of electrical timing equipment, including programme timers, and automatic and cam-operated process control equipment. A motor-driven multi-circuit mercury tube timer, type SAT, is shown for the first time. It is capable of continuously repeating a predetermined sequence of operations or it can stop after a single complete timing cycle.



Electrical Remote Control type SAT multi-circuit mercury tube timer

Factory and office cleaning by remote control is the revolutionary prospect held out by a product shown by Cimex-Fraser Tuson, Ltd. A heavy duty, electronically controlled polishing machine capable of covering hundreds of square yards of flooring an hour is demonstrated. The machine is experimental and it is understood that it will be some time before it comes into production.

A complete floor maintenance service is offered by Floor Treatments, Ltd., whose exhibits include a full range of "Resco" floor scrubbing and polishing equipment. Among these are the new Mark III "Poliscrub" and a re-styled single-brush economy machine. Industrial vacuum cleaners displayed by the British Vacuum Cleaner & Engineering Co., Ltd., include basic models which, with the appropriate equipment and tools, perform an impressive list of essential cleaning functions. They are suitable for wet and dry cleaning of all kinds of surfaces, from ceiling to floor, and will handle widely different

"Resco Economy" heavy duty floor polishing and scrubbing machine exhibited by Floor Treatments, Ltd.

waste materials from hot flue ashes to waste oils from sumps and inspection pits. The new "Littervac" high-powered suction sweeper exhibited by Columbus-Dixon, Ltd., is specially designed for industrial or municipal use, either indoors or out.

The use of electricity for industrial process cleaning is demonstrated on the British Electrical Development Association's stand where industrialists can see the latest developments. An example is shown of a cabinet type 3 kW ultrasonic cleaner for use with either chlorinated or aqueous based cleaning solutions to cover a wide variety of cleaning applications. On the E.D.A. stand can also be seen the "Vaqua-Blast" cleaner (Abrasive Developments, Ltd.). This provides a modified form of impact blasting using an abrasive suspended in a liquid which is delivered to a blasting nozzle by means of a high-pressure circulating pump. The cleaner imparts a satin polished finish. On another section of the stand equipment for electro-polishing parts is demonstrated. The plant also provides for electrolytic de-burring which is especially useful for awkward inside edges or where the main surface of a component must not be damaged.

Electrical insulation material and switchgear is not much in evidence at this Exhibition but on the stand of Siemens-Schuckert (Great Britain), Ltd., there are miniature circuit-breakers, switches, lightning arrestors, wiring accessories, etc. The company also shows a new infra-red heater specially designed for industrial and commercial premises.

Promoting Exports

MUCH valuable information and guidance on ways for increasing British exports are contained in the report of a working party set up by the Federation of British Industries. The main purpose of the working party, under the chairmanship of Sir Cecil Weir, was to find out if there were any gaps in the facilities for assisting firms in the development of their export trade. The report, which is published as a booklet, "A Survey of Export Trade Facilities" (F.B.I., price 5s), contains thirty-eight main conclusions and recommendations grouped under the three broad headings: education and training; market investigation; and export trade promotion.

One certain way to increase the volume of profitable exports is to increase the number of competent exporters. A large number of small firms, the working party consider, could export more than they have been doing, and will have to pay greater attention to this branch of their business. In particular they may have to regard Europe as an extension of their home market. At the same time it is thought that some of the larger firms might play a greater part in organising facilities overseas not only for themselves but for groups of exporters. The consortium idea, successfully tried in nuclear and civil engineering, could well be extended to other industries.

Considerable space is devoted in the report to methods of training and education for sales and other staff. It is recommended that employers should increase the inducements for their salesmen to learn foreign languages. Consideration should also be given by the Government, in consultation with national organisations, to the feasibility of establishing a residential centre for training in the export field. Existing export courses should be broadened to give greater understanding of social conditions overseas, and industry should release more of its sales staff for daytime lecturing.

The working party call on the Government and the national organisations to establish "export councils" for the European and other non-dollar countries, and say that there should be more frequent interchange of small fact-finding trade missions between this country and others promoted by the national organisations and trade associations in co-operation with the Board of Trade. British exporters should also make fuller use of official sources of information, at home and abroad.

Among some interesting recommendations on export trade promotion, the working party suggest that a special study should be made by the Board of Trade and industry of advertising problems in the Communist countries. However, they do not think that institutional advertising, "Buy British" campaigns and special supplements should be encouraged at the expense of normal advertising. It is felt that the Government should bear the entire responsibility for financing and organising British participation at future world exhibitions, and that the amount and allocation of funds by the Government for British participation in overseas fairs should be kept under constant review. It is also recommended that a joint body should be set up by the Board of Trade, the British Council and industry for the planning and financing of British Trade Weeks overseas. In addition, the working party ask for urgent consideration of the provision of up-to-date exhibition facilities near central London, suitable for a specialised international trade fair on the scale of the present large European fairs. Another committee which is considering this question in detail is expected to report shortly.

American Design

THE likelihood that with the integration of European countries consumption habits may develop on American lines lends particular interest to a recent report published by the Organisation for European Economic Co-operation entitled "Industrial Design in the United States" (H.M. Stationery Office, price 10s).

In addition to describing in some detail the education and methods of work of American designers, the report commends the American practice of a consumer goods manufacturer concentrating on one, or at least a few, products which are closely related as regards manufacture and sales. It also considers that European manufacturers should make greater use of specialised sub-contractors rather than try as at present to make as much of the final product themselves as possible.

AUSTRALIAN NEWS

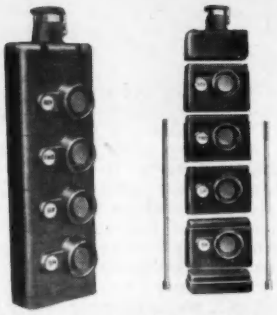
STRONG opposition to any further import cuts was expressed recently by Mr. Leon Trout, federal president of the Associated Chambers of Commerce. He said that Australia's volume of imports had already been reduced to a level where internal economic efficiency had been endangered and any further restrictions would disrupt Australia's development and increase costs by giving added protection to high-cost producers.

In Victoria the State Electricity Commission has let a contract for £147,700 to Gibson Battle (Melbourne) Pty., Ltd., and another for £77,800 to Australian Electrical Industries Pty., Ltd., for 220 kV switchgear and accessories.

NEW ELECTRICAL EQUIPMENT

Pendant Push-Button Unit

An all-insulated weatherproof pendant push-button control unit for cranes and other similar equipment is announced by NETTLE ACCESSORIES, LTD., Warren Street, Stockport, Cheshire. It consists of a combination



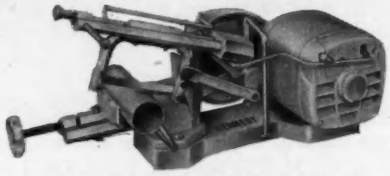
Nettle pendant push-button unit shown as a complete unit and (right) in sections

of switch housings which can be built-up by adding a top portion incorporating a cable clamp, and a base portion, to any required number of individual switch-carrying segments, up to a maximum of eight. The assembly is held together by internally-fixed bolts, and all sections of the unit fit and lock together by means of lips and bosses to prevent relative movement of segments and provide weather- and dust-proof joints.

All external parts are manufactured in "Neoprene," providing protection against ozone, greases, solvents, etc. The switches are rewirable, single-pole double-break change-over as standard, and rated for standard duty on remote control of magnetic switchgear up to 600 V a.c. or d.c. Provision is made for securing strain wires to the top portion so that no weight is carried by the body or supply cable. Certain of the items will be sold separately and, because of the specialised nature of the product, prices are available on application, these being dependent on the type and quantity required.

Portable Power Hack-Saw

An improved version of the "Kennedy" portable power hack-saw, Mk. II, has been announced by the manufacturers, W. KENNEDY, LTD., West Drayton, Middlesex. The capacity of the hack-saw has been increased to 2¾in and the ½ h.p. Hoover motor now has a thermal overload control. A new zero-cutting edge is incorporated—a simple but useful idea by means of which the extreme edge of the vice-jaw indicates the path of the saw cut. Additionally, the vice-jaw is calibrated in fractions of an inch so that short lengths of material can be cut off without the need for marking; the screws on the saw-blade clamps are placed for greater convenience on the right-hand side of the saw; and the saw-frame arm is fitted with a handle which enables the release-catch to be operated by thumb



Kennedy Mk. II portable power hack-saw

pressure alone. The price remains unchanged at £28.

Stud Welding Power Unit

The TRS.3 stud welding power unit, now available from CROMPTON PARKINSON (STUD WELDING), LTD., Crompton House, Aldwych, London, W.C.2, is designed to provide all types of C.P. stud welding equipment with the necessary d.c. power for the welding of ferrous attachments up to and including ¾in diameter.

Another model, the TRS.3C, with an inbuilt C type regulator, can also be supplied. The TRS.3C unit is suitable for full ferrous and non-ferrous stud welding over the same range of stud diameters.

The range of "Cromp Arc" rectifiers, of which the foregoing models are the latest, are claimed to offer numerous advantages over rotating plant as a source of power for d.c. stud welding. The larger units in the range are dual purpose machines which, while primarily intended for stud welding duty, are also suitable for arc welding.

The air cooled rectifiers are almost noiseless in operation and possess superior voltage/current characteristics giving improved arc stability and rapid voltage recovery; they may be adjusted for input voltages ranging from 360 to 440 V in 20 V steps. They have a high power factor on load, high electrical efficiency, and low running costs, and as well as being robust and drip-proof the units are fully mobile.

The standard TRS.3 unit weighs 415 lb and is 41in long by 28in wide by 34½in high. The price is £194 10s.

Crompton Parkinson TRS.3 welding rectifier power unit

Shaker Hearth Furnace

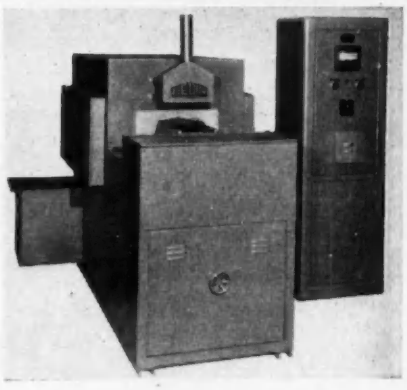
Many improvements are included in the present design of electric shaker hearth furnace that has recently been produced by HEDIN, LTD., Commerce Estate, South Woodford, London, E.18. Arranged to be used with artificial atmospheres, it is particularly useful for the bright hardening of carbon steels and the bright annealing of ferrous and non-ferrous metals, such as pressings, stampings and machine parts.

The shaker movement prevents flat components from jumping on top of one another, thus preventing inconsistency of heat treatment. The charge passing through the furnace can be regulated according to its weight and nature by an infinitely variable speed unit. Further, the arrangement of the elements can be adjusted to suit varying weights of charge, and care has been taken to prevent the cooling, even of the lightest charge, whilst it is on its way to the quench.

The hearth is of cast nickel chromium and can either be machined perfectly smooth or grooved to suit individual requirements. It is housed in a gas-tight heat resisting muffle, and is fitted with a water-cooled chute where it enters the oil quench to prevent heat being conducted to the oil.

The accompanying picture shows a standard model rated at 18 kW and capable of dealing with 50 lb/hr. The plant is supplied with a floor-mounted cubicle housing the electrical control gear. The quench tank can either be fitted with work baskets, or mechanised to bring the charge out of the quench.

Hedin 18 kW 50 lb/hr shaker hearth furnace



GENERATION and DEVELOPMENT

More Cookers Sold

As might be expected in a short month, Area Boards' sales of domestic appliances in February were generally lower than in January. Cookers, however, were an exception, the number sold rising from 22,352 to 24,103, and the rate of increase for the twelve-month period improved from 17·7 to 21·4 per cent. Washing machines were second to cookers in total sales, which numbered 12,884; this was about 3,000 below the January figure but 7,400 more than in February, 1958. The accompanying table, issued by the Electricity Council, relates only to Area Boards and the figures, of course, represent only a part of the total sales throughout the country.

ELECTRICAL APPLIANCE SALES BY AREA BOARDS

	Sales in month ended 28th February		Sales in 12 months ended 28th February	
	Total	% change compared with Feb., 1958	Total	% change over corresponding period of previous year
Cookers	24,103	+ 46·8	277,675	+ 21·4
Water Heaters—				
Immersion	8,198	+ 14·1	165,995	+ 17·0
Storage	4,439	+ 28·7	51,515	+ 23·3
Wash Boilers	5,232	− 14·0	79,411	− 1·0
Washing Machines	12,884	+ 137·8	121,607	+ 67·5
Refrigerators	3,531	+ 131·8	79,744	+ 59·9

Connection Charges

The South of Scotland Electricity Consultative Council is to ask the Board to dispense with connection charges for "all-electric" housing schemes. Bailie John Sullivan, who made the proposal at a recent meeting of the Council, said that at present about 70 local authorities in the Board's area provided facilities for electric cooking in all their houses and other councils left the choice to their tenants. It was stated that the present connection charge was £3 a house for "all-electric" estates.

Water Power in Ross-shire

A further stage in the development of hydro power in the Highlands took place on 4th April when the gates of the new Orrin dam in Ross-shire were lowered into position to impound the waters of the River Orrin. The ceremony was performed by the convener of Ross and Cromarty, Sir John Stirling, on whose estate a new artificial loch over four miles in length will be created.

This marks the third stage of a group of schemes in the Conon Valley, where there will be eight dams and seven generating stations with a combined capacity of about 107 MW and an annual output of about 450 million kWh. The Fannich scheme, the first stage, went into operation in 1950 and the last major station in the second stage, the Glascarnoch-Luichart-Torr Achilty scheme, was commissioned in 1957.

The main contractors for the Orrin project were Duncan Logan (Contractors), Ltd. The dam is believed to be the highest in Scotland. Before its construction could start a six-mile access road had to be built. The dam is about 1,000ft long and nearly 180ft in height. When full, the reservoir will store about 2,200 million cu ft of water.

Overhead Lines on Farms

At the meeting of Skipton Rural District Council on 4th April, when the question of the growing number of overhead electricity lines in the area was discussed, Councillor F. Mitchell mentioned that a farmer in the village of Salterforth already had three towers and two wooden poles on his small farm of 60 acres and the Yorkshire Electricity Board now wanted to put another 22 poles on his land, which would be a very serious obstruction to farming.

Councillor A. Garnett-Orme, who farms in one of the remotest parts of Upper Wharfedale, said he was very worried about the new practice of putting up more overhead lines parallel to existing ones. Councillor C. Nuttall, chairman of the Council, pointing out that Glusburn Moor, near Keighley, already had four parallel lines with the prospect of a fifth, said that the situation was "deplorable."

OVERSEAS

Uganda Board's Revised Tariffs

The Uganda Electricity Board has announced the introduction of revised tariffs designed to provide an additional revenue of about £115,000 this year and £154,000 in a full year. This is necessary in view of the estimated deficit of £152,000 in 1959 under the present tariffs. In 1958 revenue amounted to £1,393,700 and the Board finished the year with a small deficit of some £2,000. It is pointed out that charges have remained unaltered since 1953, except for a 5 per cent decrease four years ago, although the Board has had to meet higher interest rates and increases in the cost of commodities and manufactured goods of all kinds.

Apart from providing more revenue, several changes have been made in the basis of the tariffs. In the case of domestic supplies, for example, the "all-in" tariff with a monthly fixed charge has been superseded by a block rate with an initial charge of 90 cents (10·8d) per kWh for the first 6 kWh per room each month; 25 cents (3d) per kWh for the next 12 kWh; and 12·5 cents (1·5d) per kWh for additional consumption. For the purposes of the tariff the minimum number of rooms is three.

There is also a block tariff for hotels, clubs, hospitals, boarding schools, missions, etc., with three scales (90, 40 and 12·5 cents) based on floor area.

The industrial power tariff has been varied so that instead of a single "unit" charge there are now scales of 12·5, 11 and 9·5 cents (low voltage supplies) and 11·75, 10·25 and 8·75 cents (high voltage supplies). Changes have also been made in the maximum demand charge. For other premises requiring a supply exceeding 50 kVA there is a general maximum demand tariff with a fixed charge of 25s per kVA of m.d. and a running charge of 12·5 cents per kWh.

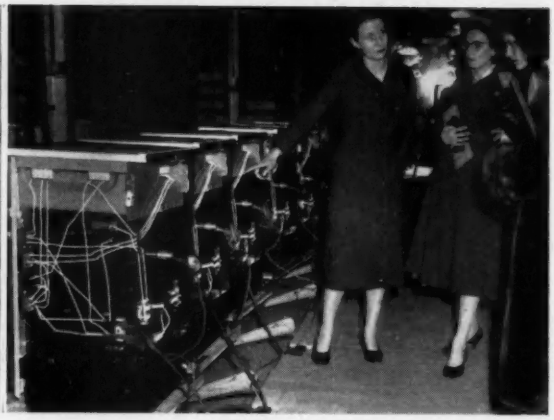
During the first quarter of this year the Board generated 83 million kWh (including 29·6 million exported to Kenya), compared with a total of 66·2 million kWh generated in the same period last year, representing an increase of 25·3 per cent. The percentage increase in total kWh generated by the Board for Uganda alone was 16·4 and for the bulk supply export to Kenya 45·5.

Stockholm District Heating

A coal/oil fired power station nearing completion at Hässelby, on Lake Mälar, will supply 60,000 people in the western suburbs of Stockholm with heat and hot water and provide the city's power network with 80,000 kW of electric power. The plant will consist of three steam boilers of AB Svenska Mashinverken manufacture and three STAL steam-turbine units coupled to ASEA generators. Coal is stored partly below sea level and partly above. The submarine storage is walled in by embankments of rock and by concrete caissons, which also constitute the quays for discharging the necessary fuel imports.

The hot-water distribution pipes are of iron insulated with a layer of cellular concrete and a further layer of ordinary concrete. Although the water will in some cases be piped a distance of up to three miles, it is estimated that the average heat loss will be no more than 5 per cent per annum.

The Swedish State Power Board, which is chiefly concerned with harnessing the country's hydraulic power, will be supplied with heat from the Hässelby plant for its new building now under construction at Racksta, about three miles from the new thermal station.



Above: Insertion of heating coils and refractory in cooker boiling plates and (right) cookers nearing the end of the assembly line before going on test

PROMOTING COOKER SALES

Visit to Belling Works at Enfield

WE reported recently that a Modern Cooking Promotional Committee had been set up by nine leading makers of domestic electric cookers to keep the public informed about new ideas and improvements in modern cookers and to emphasise the advantages of electric cooking. As the Committee's activities are directed mainly towards women it is first necessary to secure the interest of the influential women's Press and last week a visit was arranged to the works of one of the members of the Committee (Belling & Co., Ltd., Enfield) in which representatives of women's journals and of the electrical and allied Press took part.

At a luncheon which preceded the works tour Mr. Claude Simmonds (of C.S. Services, Ltd., which is handling publicity on behalf of the Committee) briefly described the Committee's aims and also stressed the superiority of electric cooking over other methods. To show the scope which existed for expansion, he said that of 15 million wired homes only about 4 million possessed electric cookers although it was being increasingly realised that modern homes and conditions demanded modern methods of cooking.

The party proceeded to the works with Mr. R. M. Hawkins, Bellings sales manager, and were divided into parties under competent guides. The extensive factory is virtually self-contained, "importing" only the raw materials. Steel, aluminium and brass sheets are received into the works and cut to basic sizes before going to power presses for shaping into the required forms. Allied with this process is the sheet metal fabrication department for bending, folding and spot-welding cooker bodies, etc., into shape. Cast parts are produced in a well-equipped foundry.

A notable section of the works is that devoted to the production of ceramic parts for both cookers and fires. Here the china clay and other raw materials are mixed to form the basis of a wide variety of components which are pressed or extruded on a battery of machines. Even the small fish-spine beads for insulating connecting wires are made in this department. After drying the manufactured parts (250,000 daily) go through two modern tunnel kilns for baking.

Attention was particularly drawn to the assembly of heating units. One feature of this department is the examination of the completed units by X-ray methods, enabling a constant check to be maintained on workmanship and materials.

The finishing and process plant was inspected including spray booths, convection ovens, infra-red stoving conveyors, and electro-plating equipment. In the vitreous-enamelling section there are three large continuous furnaces, one being electrically heated and having a loading of 750 kW.

Assembly and test procedures were watched and the appliances were followed to the dispatch department. It is noteworthy that, as in the case of the English Electric Co.'s production which we recently dealt with, there is no stock of cookers. The process is continuous and the appliances go from the dispatch department straight to their destinations.

After the tour there was an inspection of a number of the company's cookers, including a 1919-20 model with two open-coil boiling rings still in working order. Mention was made of a new series which is being introduced later this year.

Mr. C. R. Belling, the founder of the company, who is now the governing director, and is seventy-four years of age, still spends a good deal of time daily at the works.

Taunton District Reorganisation

CHANGES in the organisation of the South Western Electricity Board's Taunton District were announced last week by Mr. G. R. C. Ridge, the district manager.

The new Taunton District includes the Board's former Taunton, Bridgwater and Minehead Districts, and those parts of the Exe Valley and Barnstaple Districts which are in Somerset. Branch managers of the new District are as follows:—Minehead—Mr. G. Lovell. Bridgwater—Mr. L. G. Hooper. Glastonbury—Mr. E. R. Lunnon. Burnham-on-Sea—Mr. H. W. Jefferis. Dulverton—Mr. A. J. Luxton. Langport—Mr. E. W. Garwood. The Branch managers are responsible directly to the District office at Taunton.

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets developed a good deal of irregularity in the week or so following the Budget. A short burst of enthusiasm over the Chancellor's proposals, which more than satisfied all reasonable expectations, carried the average of leading industrial share prices briefly to a new all-time altitude record, but part of the advance was subsequently retraced. General Election conjectures are tending increasingly to over-ride the considerations which normally have the main influence on the course of security prices. Uncertainty on that account seems bound to act as some restraint on investment enterprise as well as an incentive to consolidate capital profits. In the electrical markets, the Chancellor's concessions might otherwise have been expected to produce livelier reactions from shares associated with the domestic goods affected by the purchase-tax cuts, or with the capital equipment for the benefit of which the new investment allowances are designed. The financial results published by B.I.C.C. were among the best items in recent company news.

Price Changes

Although the best prices were not generally held, many industrial shares have nevertheless retained useful improvements over the period covering the Budget. In the section concerned with household goods, and radio and television, the tax changes appeared to have been discounted rather fully, and produced little further impact on quotations. Hoover shares, for instance, had risen about 4s 6d during the previous week or two, and subsequently were only a few pence higher at 63s 6d. Plessey were conspicuously in favour, with a rise of 3s 9d to 77s 6d, and Telegraph Condenser gained 1s 6d to 42s 6d. On the other hand, Decca, E.M.I., Thorn Electrical and E. K. Cole lost a little ground on balance. S. Smith, at 13s 3d, participated in the general rise in motor-car and commercial vehicle shares. In the heavier engineering sections, A.E.I. moved up to 58s 9d, C. A. Parsons to 52s 6d, and Crompton Parkinson to 13s 6d, while English Electric were well maintained.

Dividends Declared

After some fluctuation on the appearance of the results for 1958, A. Reyrolle shares remained with little net change at about 94s 6d. Profits are shown in the preliminary statement to have been maintained near the level of the previous year. With the dividend unaltered at a total of 17½ per cent the yield of 3¾ per cent continues to reflect confidence in the long term potentialities of the investment. Pressed Steel fulfilled market expectations in raising the dividend from 20 to 25 per cent for the past year, and exceeded them in announcing an improvement in the net profit from roughly £1½ to £2 million, after tax. The 5s shares were subsequently steady at 26s 6d, and the yield now approaches 5 per cent. In both of these above cases, the amount of the dividend distribution appears to be covered about three

Price Changes in

Company or Board	Nom. Value	Middle price 13th April	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
						£ s d		
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	79		3	3	3 16 0	80¼	77½
Brit. Elec. 1974/77	100	75½		3	3	3 19 6	77	74½
Brit. Elec. 1976/79	100	79	−1½	3½	3½	4 8 6	80½	77½
Brit. Elec. 1974/79	100	89		4½	4½	4 15 6	90½	87½
Overseas Electric Supply								
Calcutta Elec.	£1	18/-	+6d	6·8†	7†	13 10 0	17/3	16/-
East African Power	£1	20/9	+6d	7½	8	7 14 3	22/3	19/3
Nigerian Elec.	£1	14/6		10	10	13 16 0	15/-	13/9
Perak Hydro-Elec.	£1	14/6		12½	10	13 16 0	14/6	12/3
Electrical Shares								
Aberdare Holdings	5/-	16/-		17½	17½	5 9 6	16/3	15/6
Aerialite	1/-	9/3	−3d	51½	54	5 16 6	9/6	7/9
Allen, W. H.	£1	45/-		10	11	4 17 9	45/-	43/-
Anglo-Portuguese Tel.	£1	28/3		8	9	6 7 6	29/3	26/6
Aron Elec. Ord.	£1	57/6		15	15	5 4 3	61/6	57/6
Assoc. Elec. Ord.	£1	58/9	+1/3	15	15	5 2 3	59/-	53/9
Automatic Tel. & El.	£1	80/-	+2/6	17	17	4 5 0	82/-	77/6
Babcock & Wilcox	£1	52/6		15	13‡	4 19 0	53/9	45/6
Bakelite	10/-	27/-	+9d	15	15	5 11 0	27/6	22/-
Baldwin, H. J.	2/-	3/-		20	20	—	3/-	2/3
Berry's Electric	5/-	15/9		10	10	3 3 6	15/9	10/9
Bowthorpe Holdings	2/-	14/6	+6d	37½	25*	3 9 0	14/6	11/9
British Elec. Traction: Def. Ord. "A"	5/-	36/6	+1/-	25	25	3 8 6	40/-	35/6
B.I. Callender's	£1	52/9	+3/9	12½	13½	5 2 3	53/-	44/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/6	19/9
British Thermostat	5/-	40/-	+1/-	25	30	3 15 0	40/-	37/-
British Vac. Cleaner	5/-	7/6	+3d	10	7½*	5 0 0	7/9	4/6
Brook Motors	10/-	53/9		25	24½*	4 10 0	54/-	46/-
Bulgin, A. F.	1/-	9/3		45	50	5 8 0	9/3	6/9
Bulpitts	5/-	12/6		—	15	6 0 0	13/-	10/-
Burco Dean	5/-	13/3	+3d	22½	16*	6 0 9	13/3	12/3
Cable & Wireless: Ord.	5/-	14/-	+3d	10	10*	3 11 6	14/-	12/3
4% Loan	100	94½		4	4	4 4 9	95	93
Chloride El. Storage "A"	£1	74/3	+6d	17½	17½	4 14 3	74/6	65/6
Clarke Chapman	£1	61/3		27½	13½*	4 9 9	66/3	60/-
Cole, E. K.	5/-	18/3	−3d	17½	17½	4 16 0	21/3	17/3
Contactor Switchgear	5/-	12/6		20	14*	5 12 0	13/-	12/-
Cossor, A. C.	5/-	8/3	+9d	2½	Nil	Nil	9/-	6/3
Crabtree	10/-	31/-	+1/-	20	20	6 9 0	31/6	28/-
Crompton Parkinson	5/-	13/6	+3d	16	12*	4 9 0	13/9	11/9
Davis & Timmins	5/-	14/-		22½	18	6 8 6	15/3	14/6
De La Rue	10/-	34/6	+6d	35	17½*	5 1 6	35/-	30/3
Decca "A"	4/-	34/3	−1/6	43½	50	5 16 9	40/3	34/3
Desoutter	5/-	23/3		32½	21½*‡	4 13 3	23/3	19/-
Dewhurst	2/-	7/6	−6d	20	20	5 6 9	8/3	7/3
Dictograph Tel.	2/-	7/9		20	20	5 3 3	7/9	7/-
Dubilier Condenser	1/-	3/9		30	20*	5 6 9	4/-	3/3
Duport	5/-	11/-	+6d	25	12½*	5 13 9	11/-	10/3
E.M.I.	10/-	56/9x.d.	−1/-	15	20*‡	3 10 6	64/6	50/-
Electrical Apparatus	5/-	13/6		12½	14½	5 2 6	14/-	13/-
Electrical Components	5/-	11/6		12½	12½	5 8 9	11/9	10/6
Elec. Construction	£1	30/-		8½	8½	5 13 3	30/3	27/9
Elliott-Automation	5/-	20/9	+1/-	—	10‡	2 8 3	20/9	16/9
Enfield Cable Ord.	£1	18/6	−1/-	Nil	2½	2 14 0	22/3	16/3
English Electric	£1	65/-		14	14	4 6 3	65/6	56/9
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/9	12/3
Ericsson Tel.	5/-	23/3		12†	13†	4 17 6	27/3	25/9
Ever Ready	5/-	26/6		37½	20*	3 15 6	26/6	22/-
Falk Stadelmann	£1	27/6	+1/3	17½	10*‡	7 5 6	32/9	26/3

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

times over by the available surplus of profits.

Good Features

Automatic Telephone and Electric shares have been supported up to 80s in advance of the final dividend and annual results due to be declared by the end of this month, and the demand for Bowthorpe Holdings persisted up to 14s 6d. Sun Electrical spurted suddenly from 73s to 80s, while A. C. Cossor were active and higher at 8s 3d. Philips Lamps added a further 3s 6d to previous large advances, reaching 113s, and others to show useful improvements included Midland Electric Manufacturing at 45s x.d., Ward & Goldstone at 40s 6d, and Watford at 9s. In the cable group, Enfield picked up to 18s 6d, after a relapse to 16s, and a revival of interest in Johnson & Phillips raised the price 2s to 26s 3d. The 5s shares of Switchgear & Cowans have been in favour since the preliminary statement of the annual results was issued and were further supported after the appearance of the full report.

Electrical Investments

Company or Board	Nom. Value	Middle price 13th April	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1959 Highest	1959 Lowest
Electrical Shares—continued								
G.E.C	£1	34/-	−1/-	12½	10	5 17 9	40/3	31/3
G.E.C. 6½% Pref.	£1	21/-		6½	6½	6 3 9	21/6	20/3
General Cables	5/-	8/9		24	15	8 11 6	9/-	7/6
Greenwood & Batley	£1	82/-	+2/6	17½	20	4 17 6	83/9	75/-
Hackbridge Holdings	5/-	14/3	−6d	20	20	7 0 3	15/6	14/3
Hackbridge & Hewittic	5/-	14/3	−3d	20	20	7 0 3	15/9	13/9
Head Wrightson	5/-	28/6		22½	17½*	3 1 6	28/6	24/3
Heatrae	2/-	9/-		15	20	4 9 0	9/-	7/6
Holophane	5/-	15/6		37½	22½*	7 5 3	16/6	15/6
Hoover	5/-	63/6	+6d	50	60	4 14 6	65/3	55/-
I.C.I.	£1	34/6x.d.		12	8*	4 12 9	38/3	33/-
Intl. Combustion	5/-	35/9	+3d	25	30‡	4 4 0	36/-	29/9
Intl. Computers & T.	£1	65/9	+9d	—	8‡	2 8 9	70/3	57/6
Johnson & Phillips	£1	26/3	+2/-	10	5	3 16 3	30/6	22/-
Lancashire Dynamo	£1	51/9	+3d	11	11	4 5 0	51/9	42/-
Laurence Scott	5/-	17/3		15	15	4 7 0	17/6	16/6
Lister, R. A.	£1	38/6		10	12½	6 9 9	41/-	32/9
Lucas, J.	£1	46/-x.d.		7½	10‡	4 7 0	46/6	43/3
Marconi Marine	£1	39/6		10	10	5 1 3	48/6	40/6
Marryat & Scott	2/-	9/6	+3d	35	37½	3 19 0*	9/6	8/6
Mather & Platt	£1	43/-	+1/-	15	10‡*	4 19 3	51/6	41/3
Metal Industries	£1	45/-	−6d	9	14	6 4 6	46/-	39/9
Midland Elec. Mfg.	£1	45/-x.d.	+1/9	12½	10*	4 9 0	45/-	41/6
Morphy-Richards	4/-	22/6		20	20	3 11 0	22/6	18/-
Murex	£1	48/9	−9d	20	17½	7 3 6	49/6	42/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	2/6		17½	17½	7 0 0	2/9	2/6
Parsons, C. A.	£1	52/6	+1/3	8½	7½*	2 17 3	55/9	47/3
Philips' Lamps	Fl.10	113/-	+3/6	14	14	2 6 9	116/-	88/-
Plessey	10/-	77/6	+3/9	30	30	3 17 6	77/6	70/6
Pye	5/-	14/9		12½	12½	4 4 9	16/9	13/9
Pyrotenax	5/-	37/-		—	27½‡	3 14 3	38/3	33/9
Reliance Clifton	5/-	17/9		13½	15	4 4 6	19/9	17/6
Reyrolle	£1	94/6	−6d	17½	17½	3 14 0	98/-	86/6
Rheostatic	4/-	8/9		12½	12½	5 14 3	9/3	8/3
Richardsons Westgarth	10/-	15/3		16‡	8½*	5 11 0	15/3	13/9
Scottish Cables	4/-	14/3	+6d	27½	27½	4 9 6*	16/3	13/3
Simon-Carves	5/-	31/9	−3d	20	25	3 18 9	32/-	28/6
Smith (England), S.	4/-	13/3	+6d	20	12½*‡	3 15 6	13/3	11/6
Southern Areas	£1	11/-		7½	Nil	Nil	14/9	11/-
Strand Elec.	5/-	8/9		15	15	8 11 6	9/-	8/6
Sturtevant	5/-	17/9	+3d	15†	15†	7 7 0	19/-	17/-
Sun Elec.	£1	80/-	+7/-	25	25	6 5 0	80/-	66/-
Switchgear & Cowans	5/-	12/6x.d.	+3d	22½	15*	6 0 0	13/-	10/3
Taylor Tunnicliff	5/-	22/9	−6d	17½	17½	3 17 0	26/-	18/-
T.C.C.	10/-	42/6	+1/6	25	25	5 17 9	42/6	38/-
Telephone Mfg.	5/-	5/6	+3d	10	10	9 1 9	5/6	4/9
Telephone Rentals	5/-	13/6	+6d	12½	12½‡*	4 12 6	13/6	11/9
Thompson (John)	5/-	25/6	+6d	25	25	4 18 0	25/6	22/9
Thorn Elec.	5/-	33/9	−1/3	17½	17½	2 11 9	38/6	26/3
Thornycroft	£1	23/9	+1/3	12½	7½	6 6 3	23/9	20/6
Tube Investments	£1	83/-	+6d	15	17½	4 4 3	85/3	71/6
Vactric	5/-	37/6		25	25	3 6 9	44/6	26/3
Veritys	5/-	2/6		12½	2½	—	5/-	1/3
Walsall Conduits	4/-	19/-	+9d	20	22½	4 14 9	19/-	16/9
Ward & Goldstone	5/-	40/6	+1/6	40	25*	3 1 9	40/6	30/6
Watford	2/-	9/-	+1/-	25	25*	5 11 0	9/-	7/6
Westinghouse	£1	42/6		10	10	4 14 3	47/-	39/6
West, Allen	5/-	14/-	+3d	15	12½*	4 3 3‡	14/-	11/9
Wolf Electric	5/-	8/3		10	10	6 1 3	8/6	8/-

B.I.C.C. Results

Financial results announced by British Insulated Callender's Cables were sufficiently ahead of expectations to make the shares a conspicuous exception to the generally reactionary state of post-Budget markets. The quotation was advanced from 49s to 52s 9d on the strength of the increase announced in both the earnings and dividend for 1958. The expansion of profits from £2·67 to £3·29 million, after tax, suggests a marked improvement in profitability during the second half of the year, for in the interim report covering the first six months the directors had not expected the final results to differ materially from those of the previous year. In the event, they are able to recommend an increase in the dividend from a total of 12½ to 13½ per cent, whilst retaining apparently a rather larger proportion of profits than before; the new rate is covered approximately two-and-a-half times by the net distributable surplus. According to the preliminary statement the money value of group sales was a little lower at £110 million, but the difference was more than accounted for by lower prices; the physical volume was in fact higher. Shares issued last January in exchange for those of T.C. & M. do not qualify for the final dividend just declared.

Falk, Stadelmann Issues

The £1 shares of Falk, Stadelmann are now quoted ex-two recent issues, the first a free distribution of one new share for every two held, by way of a capitalisation of reserves, and the other a cash offer of new shares in the proportion one for three at a price of 20s 6d. Issued ordinary capital is now raised to £1·16 million. The cash issue will provide the extra working capital required by the company and its subsidiaries to finance higher turnover and longer credit facilities for exports. Regarding dividend prospects for the financial year ended last month, the directors have expressed the intention of paying a total of 10 per cent, divided between an interim of 5 per cent (of which the new shares issued for cash would participate in half) and a final at the same rate. At 27s 6d the shares give a prospective yield of 7½ per cent.

REPORTS and DIVIDENDS

British Insulated Callender's Cables, Ltd.—The group sales for 1958 amounted to £110 million, as compared with £111 million for 1957. The directors point out, however, that the fall in value is more than accounted for by the lower average prices ruling in 1958, particularly for copper, and the physical volume of sales has increased. The trading surplus in 1958 was £8,808,610 (against £7,832,872), and after meeting all charges, including £2,005,839 for depreciation and £3,147,752 for taxation, the group net profit is £3,292,989 (against £2,670,051), of which £3,090,969 (£2,485,977) is applicable to the holding company. Capital reserves receive £776,735 and revenue reserves £700,366. It is proposed to pay a final dividend of 9½ per cent (against 8½ per cent), making 13½ per cent (12½ per cent) for the year, leaving a balance added to the carry-forward of £330,793.

Telegraph Condenser Co., Ltd.—The main figures in the accounts for 1958 were given in our issue of 13th March. In his statement, which has been circulated to shareholders, Mr. D. W. Aldridge (chairman) says that, in general, trading conditions at home during 1958 were favourable, and the relaxation of hire-purchase restrictions last autumn had the effect of increasing the demand for components used in radio and television sets, as well as in domestic appliances. Sales overseas were well maintained. The Canadian subsidiary has made considerable headway during the year, in spite of the trade recession in that country. Exports to Canada have been supplemented by substantial local manufacture, which has resulted in the company being able to obtain an increased share of the available market. With regard to the outlook, Mr. Aldridge says that there has been no noticeable slackening in demand since the beginning of the current year and, in most departments, a high level of production has been maintained.

Parkinson & Cowan, Ltd.—The consolidated trading profit for 1958 amounts to £361,677, as compared with £538,078 for 1957, and after meeting all charges, including £98,075 for taxation, the net profit is £151,478 (against £129,361), to which is added a surplus on the sale of investment of £38,883, and net credits, including taxation adjustments relating to previous years, of £9,141, making £199,502, of which £167,967 is available to the parent company. Reserves receive £100,000 and the ordinary dividend for the year is maintained at 9 per cent. The balance carried forward is £268,407 (against £227,256 brought in).

In his circulated statement, Mr. H. P. Barker (chairman and managing director) says that the gross trading profit remained at a disappointing level until the Government relaxed hire-purchase restrictions in October. Thereafter operations benefited, though not sufficiently to offset the doldrums of the earlier months. They are engaged in the replacement of much old plant at the Birmingham appliance factory. The business in domestic appliances which started the year poorly has accelerated rapidly since hire-purchase restrictions were removed. There are signs that the unhealthy boom conditions which prevailed in the industry for a few months at the end of the year are now slackening off. Measurement, Ltd., and Parkinson Cowan Instruments, Ltd., are involved in the manufacture of hydraulic, electro-mechanical and electronic apparatus for liquid process control and for diverse applications in the gas, water and electricity supply industries. In these fields they are making solid progress. Their orders for specialised instruments and apparatus are steadily growing.

The British Aluminium Co., Ltd.—Group manufacturing and trading profits for 1958 amounted to £2,105,394 as compared with £3,020,706 for 1957, to which is added investment income of £245,546, making £2,350,940. Taxation absorbs £1,180,024 and the net profit is £1,030,242 (against £1,247,389), of which £922,073 is attributable to the parent company. A sum of £201,000 is transferred from stock reserve, and with £541,783 brought in, the balance available is £1,664,856. The dividend for the year is 17½ per cent, against 12 per cent, of which the interim payment of 4 per cent was on smaller capital. The balance carried forward is £553,367.

Sturtevant Engineering Co., Ltd.—The group profit for 1958 amounts to £527,645, as compared with £530,270 for the preceding year, and after providing £262,025 for taxation, the net profit is £265,620 (against £226,445). General reserve receives £120,000. It is proposed to pay a final dividend of 12 per cent, tax free, maintaining the distribution for the year at 15 per cent. The balance carried forward is £139,183 (against £121,711 brought in).

Senior Economisers, Ltd.—The group profits for 1958 amount to £349,433, as compared with £262,909 for the parent company only in 1957. Taxation requires £185,541. It is proposed to pay a final dividend of 25 per cent, again making 50 per cent for the year, and in addition to pay a special interim dividend of 12½ per cent to mark the company's twenty-fifth anniversary. A two-for-one scrip issue is also proposed. The directors think it likely that for some time after 1959 profits may well show a considerable drop because long-term contracts now on hand will show reduced profit margins and as a result of changes in trading conditions it cannot be assumed that new long-term contracts will be obtained on as favourable terms as in the past. On the other hand, they state that they have no lack of confidence in the group's future. For these reasons shareholders are warned that they should not for some time after 1959 expect any increase in the amount to be distributed by way of dividend.

Murphy Radio, Ltd.—The group profit declined from £599,317 for 1957 to £451,400 for 1958. Taxation requires £250,448, and after adding tax adjustments the group net profit is £207,724 (against £266,829). General reserve receives £100,000 and the dividend for the year is maintained at 20 per cent. The balance carried forward is £281,146 (against £298,628 brought in).

Simms Motor & Electronics Corporation, Ltd., has now acquired the whole of the issued share capital of Aircraft Steel Structures, Ltd., of which it has held one-third since 1956.

Blaw Knox, Ltd., report that the net profit for 1958 (subject to audit) is £105,931, as compared with £107,772 for 1957. Taxation absorbed £120,439. The dividend for the year is maintained at 30 per cent by a final payment of 20 per cent.

Morphy-Richards, Ltd., announces that the payment of the interim dividend of 10 per cent (already announced) has been postponed from 15th April to 25th April in order that the net amount to holders reflects the benefit of the reduction in the standard rate of taxation.

A. Reyrolle & Co., Ltd., report a trading profit for 1958 of £2,711,981, as compared with £2,762,274, and after providing £1,353,724 for taxation the net profit is £1,358,257 (against £1,353,086). It is proposed to pay a final dividend of 11 per cent, maintaining the distribution for the year at 17½ per cent.

The Perak River Hydro-Electric Power Co., Ltd., has decided not to pay an interim dividend (against 4 per cent).

Strand Electric Holdings, Ltd., is paying an interim dividend of 6 per cent. No interim dividend was paid last year, but the distribution for the year was 15 per cent.

J. & F. Stone Lighting & Radio, Ltd., has declared an interim dividend of 10 per cent (unchanged).

Joseph Lucas (Industries), Ltd., has declared an interim dividend of 2½ per cent (unchanged).

The Electrical Apparatus Co., Ltd., is paying an interim dividend of 4½ per cent (unchanged).

Pifco Holdings, Ltd., has announced an interim dividend of 7½ per cent (unchanged).

New Companies

Craigpark Electric Cable Co., Ltd.—Registered 1st April. Capital £2. Manufacturers of and dealers in all kinds of insulated cables, and wires for the transmission of electrical

energy, etc. Directors: D. Norman-Thomas (director of Conollys (Blackley), Ltd., etc.) and J. P. Hourston (director of Croydon Cable Co., Ltd., etc.). Regd. office: Norfolk House, Norfolk Street, W.C.2.

Willie E. Collins, Ltd.—Registered 1st April. Capital £30,000. To acquire all or part of Willie E. Collins Holdings, Ltd. (formerly Willie E. Collins, Ltd.), and to carry on the business of manufacturers of and dealers in electrical apparatus, machines, accessories and equipment of all kinds, etc. Directors: R. Collins (chairman) and Mrs. Gwendoline Rogerson. Regd. office: 125, Albion Street, Leeds, 1.

S. Barron & Co., Ltd.—Registered 25th March. Capital £5,000. Electrical engineers, general, electrical and refrigeration installation contractors, manufacturers of and dealers in radio and television sets, etc. Directors: S. Barron and Mrs. Amy Barron. Regd. office: 445, Firth Park Road, Sheffield.

H. G. Kingshott, Ltd.—Registered 25th March. Capital £5,000. To acquire the business of an electrical engineer and contractor carried on by H. G. Kingshott at Godalming, Surrey, etc. H. G. Kingshott is the first director. Regd. office: 44, High Street, Godalming, Surrey.

P. H. Lawrence, Ltd.—Registered 26th March. Capital £2,500. Vendors by wholesale or retail, repairers, distributors or manufacturers of electrical machinery, etc. Directors: P. H. Lawrence, Mrs. Gladys Lawrence, P. J. Lawrence and Pauline M. Wood. Regd. office: 38, Market Street. Tamworth.

Chilton Aircraft Holdings, Ltd.—Registered 26th March. Capital £51,000. To acquire the whole of the issued share capital of Chilton Electric Products, Ltd., and Chilton Aircraft Co., Ltd., for the purpose of co-ordinating and developing the activities of the said companies, etc. The first directors are A. R. Ward, C. A. F. Fuller-Shapcott, Col. E. J. S. Ward and J. M. Freeman. Solicitors: Theodore Goddard & Co., 5, New Court, W.C.2.

D. J. McPherson, Ltd.—Registered 12th March. Capital £5,000. Mechanical, electrical and electronic and hydraulic engineers, etc. Directors: Daphne J. Morgan and J. Morgan. Regd. office: 26, Eltham Road, S.E.12.

Tecol Engineering Co. (Liverpool), Ltd.—Registered 18th March. Capital £400. Manufacturers of earthing clips, cable saddles and clips and all kinds of electrical accessories, etc. Directors: R. Greaves, Velma E. Greaves and Joan C. Johns. Regd. office: 108-114, Derby Road, Bootle.

Guy R. Fountain, Ltd.—Registered 19th March. Capital £100. Manufacturers, installers, maintainers, exporters and importers of and dealers in electrical apparatus, reproducing, recording and transmitting apparatus, etc. Regd. office: Norwood Road, West Norwood, S.E.27.

Bobbies (Elm Park), Ltd.—Registered 18th February. Capital £100. Electrical engineers and contractors, electricians, electronic, radio and television engineers, etc. Directors: H. Carson and Estelle Carson. Regd. office: 15, Station Parade, Elm Park, Hornchurch, Essex.

Worston, Ltd.—Registered 18th February. Capital £100. Electrical engineers and general electrical installation contractors, etc. Directors: E. Walton and J. Worsley. Regd. office: 189, Halliwell Road, Bolton.

Lupus Electrical Products, Ltd.—Registered 13th March. Capital £5,000. Electrical engineers and manufacturers of electrical equipment and component parts, etc. Directors: H. W. Wolff, E. A. Abbott and T. M. Fryer. Regd. office: Lupus Works, Oxford Road, Altrincham, Ches.

Lupus Kindlers, Ltd.—Registered 13th March. Capital £5,000. Other particulars are similar to those of Lupus Electrical Products, Ltd.

W. R. Ward & Son, Ltd.—Registered 20th March. Capital £100. Manufacturers and repairers of, agents for and wholesale and retail dealers in artificial lighting, apparatus, electrical plant, radio and television sets, etc. Directors: W. R. Ward and Sheila Ward. Regd. office: 9, Swarcliffe Parade, Leeds, 14.

W. E. Manin, Ltd.—Registered 20th March. Capital £8,000. Electrical engineers and contractors, etc. Directors: W. A. E. Manin and Mrs. Marjorie E. Manin. Regd. office: 35, Station Street, Sittingbourne, Kent.

Eagle Electrical Engineering Co. (Bedford), Ltd.—Registered 23rd March. Capital £200. Electrical equipment specialists, etc. Directors: D. F. Keens and A. N. Roue. Regd. office: Holt Row, Bedford.

Increases of Capital

Atlas Electric & General Trust, Ltd.—Increased by £300,000, in £1 ordinary shares, beyond the registered capital of £8,400,000.

Grundig (Great Britain), Ltd.—Increased by £100,000 in £1 ordinary shares, beyond the registered capital of £100,000.

Liquidation

Willie E. Collins Holdings, Ltd., electrical wholesalers, 125, Albion Street, Leeds, 1.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. D. Armitage, Brotherton Chambers, Westgate, Leeds, appointed 1st April.

A new company, Willie E. Collins, Ltd., has been formed to acquire the business. (See "New Companies" section).

Bankruptcies

C. A. Norwood, lately carrying on business at 38, Thornbury Road, London, S.W.2, as an electrical contractor.—Last day for receiving proofs for dividend 17th April. Trustee, Mr. W. J. W. Hill, 58-61, York Terrace, Regent's Park, N.W.1, Official Receiver.

A. E. Young and **G. A. B. Thompson,** trading as Thompson & Young at Station Road, Darley Dale, and also formerly at The Cross, Bonsall, Derbyshire, as electrical contractors and radio and television engineers.—Trustee, Mr. P. Cardwell, 93, Queen Street, Sheffield, 1, appointed 2nd April.

J. S. Hibbert, residing at 47, Parliament Street, Morecambe, formerly residing at 64, Knott Lane, Bardsley, Ashton-under-Lyne, and carrying on business at 39, Ashton Road, Oldham, electrician.—Last day for receiving proofs for dividend 21st April. Trustee, Mr. J. Tye, 20, Byrom Street, Manchester, 3, Official Receiver.

Gertrude Revere, 19, High Street, Wanstead, London, E.11, shopkeeper and vendor of electrical goods, and also of 120, Stoke Newington Road, London, N.16, and 8, Felton Street, London, N.1.—Public examination 5th June at Bankruptcy Buildings, Carey Street, London, W.C.2.

Wall-Mounting Lanterns at Hendon

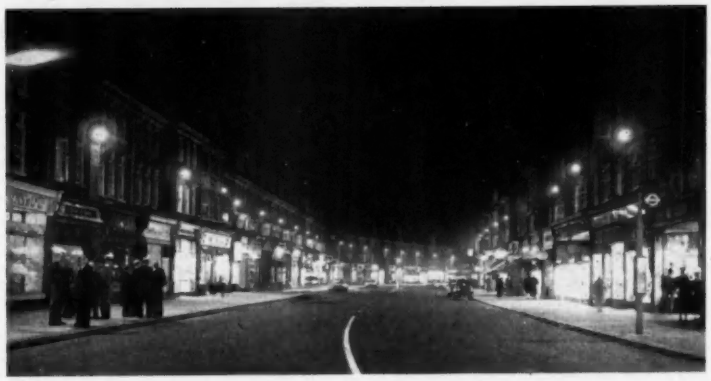
A new G.E.C. street lighting system, consisting of 40 wall-mounting lanterns, each housing one 140 W sodium lamp, was inaugurated on 1st April along a section of Golders Green Road, Hendon. The G.E.C. Z8240 fluorescent lantern was chosen because, with its attractive design and compactness, it harmonises with the architectural surroundings of the area to be re-lighted.

Since sodium lighting is proposed to be used extensively throughout the borough, the company was asked to modify the lantern to house a sodium lamp, and an order was placed after a small trial installation had been inspected and approved. The lantern has a body consisting of an aluminium girder framework covered with aluminium sheet. It is totally enclosed by a hinged door, glazed with broad reeded glass, and optical control of the 140 W sodium lamp is obtained by a trough reflector with a specially designed contour.

The lanterns are opposite-mounted at a height of 25ft and spaced 40ft apart. Particular attention was paid when installing the lanterns to ensuring that the main beams from the units would give an even distribution of light on the two lanes of the carriageways while illuminating the pavements and shopfronts adequately. The gear necessary to operate the lamps is installed in sheet steel boxes concealed on the building faces.

The new lighting was planned by the former borough engineer, Mr. J. L. Pelham, and the work was carried on subsequently by his successor, Mr. F. J. Cave. The installation work was carried out by the Eastern Electricity Board (Hendon District), and involved fixing on the building faces over a quarter of a mile of special insulated cables.

New lighting installation along part of Golders Green Road, Hendon



NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

10875. Hunt (Capacitors), Ltd., A. H.—Manufacture of capacitors and other electrical units. 13th April, 1955. (Cognate application 17276, 11th June, 1954.) (811981.)

11240. Postmaster General.—Information transmitting circuits. 15th April, 1955. (811990.)

23285. Electric & Musical Industries, Ltd.—Servo-mechanisms especially for machine tools. 11th August, 1955. (812054.)

31353. British Thomson-Houston Co., Ltd.—Electric carbon arc supply circuits. 19th October, 1955. (812055.)

34604. Automatic Telephone & Electric Co., Ltd.—Subscribers' line circuits for use in telephone systems. 27th October, 1955. (811994.)

1955

2230. Marx, E.—Electrical connectors. 25th April, 1956. (811932.)

11844. Fairchild Camera & Instrument Corporation.—Variable ratio photo-electric copy reproducing machine. 25th April, 1955. (812057.)

15737. General Electric Co., Ltd.—Manufacture of magnetisable powder cores. 15th August, 1956. (811935.)

19543. A.M.P., Inc.—Electrical connections and methods of and apparatus for use in making same. 6th July, 1955. (811996.)

20905. Republic Steel Corporation.—Apparatus for forming ingots by electric heating. 19th July, 1955. (811917.)

22656. Hunt (Capacitors), Ltd., A. H.—Capacitors. 7th August, 1956. (811982.) 22761 and 22783. Electrical capacitors. 2nd August, 1956. (811983/4.)

23348. Radio Corporation of America.—Mask assembly for cathode-ray tubes. 12th August, 1955. (811936.)

32875. Parsons & Co., Ltd., C. A.—Nuclear reactors. 26th October, 1956. (812004.)

26253. Tokyo Shibaura Electric Co., Ltd.—Transceivers. 14th September, 1955. (812082.)

36293. General Electric Co., Ltd.—Dynamo-electric machine brushgear. 17th December, 1956. (811787.)

36526. Zavody V.I. Lenina Narodni Podnik Novotny, B., and Koci, M.—Electromagnetically actuated fluid control valves. 20th December, 1955. (811788.)

36611. International Business Machines Corporation.—Pulse signal translating apparatus. 21st December, 1955. (811943.)

1956

84. Parsons & Co., Ltd., C. A.—Nuclear plant. 22nd November, 1956. (811856.)

4832. Belling & Lee, Ltd.—Electrical fuses. 8th February, 1957. (812070.)

6244. United Kingdom Atomic Energy Authority.—Vessels for processing nuclear fuel. 29th January, 1957. (811790.)

6577. Elektro-Mechanik G.m.b H.—Electric adjusting control for controlling or regulating, particularly for regulating the electrodes of electric-arc furnaces. 2nd March, 1956. (812072.)

8735. General Electric Co., Ltd.—Electric lighting fittings. 15th May, 1957. (812009.)

11162. Sparcatron, Ltd.—Electric disintegration of conductive materials. 4th April, 1957. (Cognate application 21006, 6th July, 1956.) (812012.)

11194. General Electric Co., Ltd.—Semiconductor devices. 1st April, 1957. (811792.)

11825. General Electric Co., Ltd.—Radiographic apparatus. 17th April, 1957. (812c77.)

18315. Sylvania Electric Products, Inc.—Means for adjusting the orientation of lamp mounts in lamp-making machines. 13th June, 1956. (812019.)

20253. Cinch Manufacturing Corporation.—Electrical connectors and electrical assemblies employing same. 29th June, 1956. (811988.)

22036. Standard Telephones & Cables, Ltd.—Method of assembly of an electron lens structure. 17th July, 1956. (811872.)

25289. Sperry Rand Corporation.—Wave guide. 17th August, 1956. (812027.)

29990. Philips Electrical Industries, Ltd.—Circuit arrangements for converting low voltages into high voltages by means of a transistor oscillator. 2nd October, 1956. (812085.)

33540. British Electric Resistance Co., Ltd.—Adjustable electrical contact devices. 25th September, 1957. (811883.)

34371. Compagnie Générale d'Electricité.—Flexible wave guide. 9th November, 1956. (812032.)

35720. Fielden Electronics, Ltd.—Transducers for converting forces into direct electric currents. 22nd November, 1956. (811888.) 35722. Force to d.c. transducers. 22nd November, 1956. (811889.)

36120. General Electric Co., Ltd.—Cathode-ray tubes. 26th November, 1957. (812089.)

37529. Morgan, W. J.—Electric battery acid-level indicating devices. 6th December, 1957. (812034.)

1957

2784. Western Electric Co., Inc.—Electromagnetic wave guide transformers. 25th January, 1957. (811807.)

5098. Philips Electrical Industries, Ltd.—X-ray apparatus. 14th February, 1957. (811955.)

5933. Cirilli, B. P. J., and Cirilli, M. J. A.—Liquid blast circuit-breakers for high voltage currents. 21st February, 1957. (812094.)

9467. Western Electric Co., Inc.—Electrical circuits employing transistors. 22nd March, 1957. (811958.)

10185. Sperry Rand Corporation.—Pulse generating apparatus. 28th March, 1957. (811815.)

11020. Calor-Emag Elektrizitäts-A.G.—Electrical switchgear. 4th April, 1957. (812096.)

11909. International Resistance Co.—Electrical delay lines. 11th April, 1957. (811817.)

12022. Manning, Maxwell & Moore, Inc.—Pressure operated electric switches. 12th April, 1957. (811818.)

12247. Westinghouse Electric International Co.—Electric fusible devices. 15th April, 1957. (811962.)

12591. Schulmeister G.m.b.H.—X-ray unit. 17th April, 1957. (811819.)

20321. Forges et Ateliers de Constructions Electriques de Jeumont.—Electric circuit-breakers. 27th June, 1957. (812101.)

21735. Siemens-Schuckertwerke A.G.—Grid controlled current convertors. 9th July, 1957. (812103.)

24877. Müller, G.—Electrical connectors. 7th August, 1957. (811825.)

1958

1709. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Receivers for electric remote control systems. 17th January, 1958. (812048.)

26169. Cinch Manufacturing Corporation.—Electrical connectors and electrical assemblies employing same. 29th June, 1956. (Divided out of 811988.) (811989.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 1st May:—

Electromatic. No. 774,969. Class 7. Electrically operated spraying apparatus for use by hand.—Snap, Ltd., 153, Mason's Hill, Bromley, Kent.

Simco. No. 768,830. Class 9. Electrical apparatus for use in causing the dissipation of static charges by ionisation.—Sheridan Croxted, Ltd., 296-302, High Holborn, London, W.C.1.

Hivar. No. 782,503. Class 9. Electrical apparatus and component parts included in Class 9, but not thermionic valves, cold cathode tubes, suppressor tubes, or lamps.—Dennison Developments, Ltd., Soho Hill, Handsworth, Birmingham, 19.

Kingsland. No. B784,412. Class 9. Scientific and electrical apparatus and instruments included in Class 9; and photographic, cinematographic and optical apparatus and instruments.—Benjamin Marsh, 432, Kingsland Road, London, E.8.

Televac. No. 784,538. Class 9. Electric vacuum cleaners and television receivers.—H. E. G. Gosling (Bournemouth), Ltd., 884, Christchurch Road, Bournemouth.

Transicord. No. 784,618. Class 9. Scientific and electrical apparatus included in Class 9. Electro Methods, Ltd., Caxton Way, Stevenage, Herts.

Simoom. No. 788,856. Class 11. Electric hair dryers (not machines). **Pifco.** No. 781,411. Class 11. Lighting, cooking and ventilating apparatus; heating and drying apparatus; and electrically operated gas-lighters.—Pifco, Ltd., Pifco House, Watling Street, Manchester, 4.

BOOKS RECOMMENDED BY

ELECTRICAL REVIEW

ELECTRICAL WHO'S WHO: 1958-59
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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 20th APRIL

Birmingham.—Grand Hotel, 6.15 p.m. Birmingham Electric Club. "The Building of the Nuclear Power Station at Berkeley," by A. L. Shaw.

Bristol.—Electricity House, Colston Avenue, 6 p.m. I.E.E. Western Supply Group. "The Design of the 330 kV Transmission System for Rhodesia," by F. C. Winfield, T. W. Wilcox and G. Lyon.

At Gardiner, Sons & Co., Ltd., Broad Plain, 7 p.m. I.E.S. Bath and Bristol Centre. Annual general meeting.

Norwich.—Assembly House, 7.30 p.m. I.E.E. East Anglian Sub-Centre. Annual general meeting, followed by "High-Quality Sound Reproduction," by J. Moir.

Scunthorpe.—Technical College, 6.45 p.m. I.E.E. Sheffield Sub-Centre. "Silicone Electrical Insulation," by J. H. Davis.

TUESDAY, 21st APRIL

Aldershot.—Red Cross Hall, High Street, 7.30 p.m. A.S.E.E. Aldershot and Districts Branch. "Electrical Safety in the Home," by S. J. Emerson.

Canterbury. — County Hotel, 8 p.m. A.S.E.E. East Kent Branch. "Electricity in Hospitals," by A. A. Mansell.

Cheltenham.—Fleece Hotel. I.E.S. Gloucester and Cheltenham Centre. Annual general meeting.

Edinburgh.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. The Fifth Graham Clark Lecture, by Sir Arnold Plant.

Leeds.—Great Northern Hotel, 6.30 p.m. I.E.E. North Midland Utilisation Group and Graduate and Student Section. "Electricity and Milk Production," by C. D. Stone, and "Uses of Amplidynes," by J. Dawson.

Liverpool.—Merseyside and North Wales Electricity Board Industrial Development Centre, 6 p.m. I.E.S. Liverpool Centre. Annual general meeting followed by film show.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. Discussion on "The Problem of Maintenance of Electronic Equipment in the Process Industries."

76, Mark Lane, E.C.3, 5.30 p.m. Institute of Marine Engineers. Annual general meeting.

Connaught Rooms, Great Queen Street, W.C.2. Electrical Association for Women. Annual conference.

At the offices of B.I.C.C., 21, Bloomsbury Street, W.C.1. Society of Relay Engineers. 11.30 a.m. Annual general meeting. 2.30 p.m. "Recent Developments in Television Relay Cables," by J. D. S. Hinchliffe.

Newcastle-on-Tyne.—A.S.E.E. Tyneside Branch. Visit to Newcastle police station.

Portsmouth.—I.E.E. Southern Centre Graduate and Student Section. Annual general meeting.

TUESDAY, 21st APRIL to FRIDAY, 24th APRIL

London.—Caxton Hall and the Connaught Rooms. British Electrical Development Association. Annual conference for members of commercial staffs of Electricity Boards.

WEDNESDAY, 22nd APRIL

Birmingham.—Chamber of Commerce, New Street, 10.30 a.m. Combustion Engineering Association, Midland Region. "Instrumentation for Industrial Steam Raising Plant," by L. I. Young.

Bournemouth.—I.E.E. Southern Centre, 6.30 p.m. "Bournemouth's New Telephone System," by W. R. Tyson, E. J. French and G. E. Rossiter.

Glasgow.—39, Elmbank Crescent, 7 p.m. I.E.E. South West Scotland Sub-Centre. "A Train Performance Computer," by Professor E. Bradshaw, M. Wagstaff and F. Cooke.

Leicester.—Bell Hotel, 7 p.m. I.E.S. Leicester Centre. Annual general meeting.

Liverpool.—University Club, 7 p.m. British Institution of Radio Engineers, Merseyside Section. Annual general meeting.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "Electrical Supplies to Power Station Auxiliaries," by D. A. Dewison.

At the Institution of Civil Engineers, Great George Street, S.W.1, 6 p.m. Institute of Fuel. Presidential address, by T. C. Bailey.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. "The Application of Magnetic Resonance to Solid State Electronics," by Dr. D. J. E. Ingram.

A.S.E.E. North West London Branch. Visit to Farringdon Signal Box of London Transport.

THURSDAY, 23rd APRIL

Bristol.—The University, 7 p.m. I.E.E. Bristol Graduate and Student Section. "Fully Automatic Aircraft Landing Approach," by J. M. Walker.

Cardiff.—Park Place, 6 p.m. South Wales Institute of Engineers. "Cynheidre No. 2 Winder Tower and Mine Car Circuit," by H. M. Hughes and J. E. Embleton.

Croydon. — Greyhound Hotel, 8 p.m. A.S.E.E. South London Branch. "Rectifiers and their Applications," by K. D. Phillips.

Hatfield.—Technical College, 7 p.m. I.E.E. District meeting. "Cathodic Protection," by C. L. Wilson.

London.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. The Fiftieth Kelvin Lecture on "The Geophysical Year 1957-58," by Sir David Brunt.

Connaught Rooms, W.C.2, 12.30 for 1 p.m. Institute of Fuel. Annual luncheon.

Windsor Castle Hotel, Victoria, S.W.1, 6.15 for 7 p.m. Electrical Trades' Commercial Travellers' Association. Ladies' party.

Manchester.—Engineers' Club, Albert Square, 2.30 p.m. Combustion Engineering Association, North Western Region. "Capital Investment and Fuel Saving Schemes," by R. H. Potterill.

Watford.—West Herts Golf Club. A.S.E.E. Golfing Society. "Brush" Trophy.

FRIDAY, 24th APRIL

Birmingham.—Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. "Lighting and Industry in the Soviet Union," by E. H. Norgrove.

Glasgow.—39, Elmbank Crescent, 8 for 8.30 p.m. Intitution of Engineers and Shipbuilders in Scotland. Conversazione.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "Engineering Aspects of Commercial Television Programme Presentation," by T. C. Macnamara and B. Marsden.

Connaught Rooms, Great Queen Street, Kingsway, W.C.2, 6.45 for 7.15 p.m. Junior Institution of Engineers. Annual dinner.

1, Birdcage Walk, Westminster, S.W.1, 6 p.m. Institution of Mechanical Engineers. Annual meeting.

Manchester.—Reynolds Hall, College of Science and Technology, 7 p.m. Institution of Electronics. "A General Survey of Transistor D.C. Amplifiers," by H. Kemhadjian.

Midland Hotel, 7.15 for 7.45 p.m. Institution of Production Engineers, North Western Region. Dinner.

Newcastle-upon-Tyne. — King's College, 6.15 p.m. I.E.E. North Eastern Graduate and Student Section. Annual general meeting, followed by film show.

FRIDAY, 24th APRIL to SUNDAY, 26th APRIL

York.—I.E.S. Jubilee regional conference.

SATURDAY, 25th APRIL

London.—A.S.E.E. South East London Branch. 2.30 p.m. Visit to London Airport.

Manchester. — I.E.E. North Western Graduate and Student Section. Visit to Calder Hall nuclear power station.

Preston.—A.S.E.E. Preston Branch. Theatre night.

Catalogues and Lists

CONDUIT FITTINGS.—26-page illustrated and priced catalogue covering the range of conduit fittings and accessories produced by the company.—**Crown Fittings (Walsall), Ltd.**, Hatherton Lane, Leamore, Walsall.

20-page priced catalogue giving illustrations and particulars of "Egatube" non-metallic conduit, conduit fittings, and cable trunking.—**Ega Electric, Ltd.**, Holyhead Road, Wednesbury, Staffs.

CONVEYORS.—Leaflet giving particulars of the "Ritespeed" motorised conveyor pulleys designed for use with portable, mobile and stationary conveyors.—**Crofts (Engineers), Ltd.**, Bradford, 3, Yorkshire.

COUPLINGS.—15-page catalogue containing details of rigid type, pin and buffer type and gear type couplings.—**Turbine Gears, Ltd.**, Cheadle Heath, Stockport.

ELECTRICAL ACCESSORIES.—Illustrated 10-page catalogue covering a range of electric bells and pushes, staircase and time switches, electric door locks, etc.—**Fitzgibbon & Murray, Ltd.**, Smallfield Works, Horley, Surrey.

ELECTRICAL EQUIPMENT.—277-page illustrated and priced catalogue covering the wide range of equipment obtainable from the company, including wiring accessories, switchgear, portable tools, motors, lighting fittings and domestic appliances.—**Young & Wildsmith, Ltd.**, 35, Little Russell Street, London, W.C.1.

ELECTROMAGNETS.—Illustrated leaflet (130) dealing with circular type suspension electromagnets for the extraction of tramp iron from coal, limestone, slag, gypsum, ore, and similar materials carried by conveyor or chute.—**Rapid Magnetic Machines, Ltd.**, Lombard Street, Birmingham, 12.

KITCHEN AID.—Illustrated leaflet describing the "Power-Maid" multi-purpose kitchen aid which has a six-speed power unit to operate a food mixer, a blender, a juicer, a knife sharpener, and a coffee mill.—**E. A. Cannon**, Deepfields, Bilston, Staffs.

LIGHTING FITTINGS.—Three leaflets dealing with tungsten and fluorescent lighting fittings produced by the company.—**S.L.R. Electric, Ltd.**, Welbeck Works, Welbeck Road, South Harrow, Middlesex.

LINE EQUIPMENT.—Brochure (O.P.1) giving particulars of "Epifil" fibre glass portable operating poles and live line tapping equipment.—**Line Equipment, Ltd.**, 32, Queen Victoria Street, London, E.C.4.

MOTORS.—Illustrated folder describing the repair and renovation service for fractional h.p. motors which is offered by the company for machines of their manufacture.—**Crompton Parkinson (Doncaster), Ltd.**, Wheatley Hall Road, Doncaster.

REDUCTION GEARS.—Illustrated leaflet (5826) covering a range of small power worm reduction gears.—**Crofts (Engineers), Ltd.**, Thornbury, Bradford, 3.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Sydney County Council. 2nd July. Equipment for centralised control of consumer loading and street lighting. (E.S.B. 8138/59. Ten/38372.)*

Snowy Mountains Hydro-Electric Authority, Cooma North. 27th May. 330 kV lightning arrestors and surge counters. (E.S.B. 8585/59. Ten/38390.)*

Batley.—Corporation. 27th April. Street lighting equipment. (See this issue.)

Burma.—Burma Purchase Board, Rangoon. 23rd April. Electric lamps and enamelled wire. (E.S.B. 8695/59. Ten/38397.)*

Cambridge.—Corporation. Street lighting equipment. (See this issue.)

Formosa.—Central Trust of China, Taipei. 27th April. Electrical equipment, including motors, transformers and cable. (E.S.B. 7704/59/I.C.A. Ten/38188.)*

Hereford.—Corporation. 4th May. Electrical installations in forty houses. (See this issue.)

Iran.—General Administration of Ports and Navigation, Teheran. 14th June. Radio transmitting and receiving stations. (E.S.B. 8714/59. Ten/38428.)*

Liverpool.—City Council. 2nd May. Sound reinforcing equipment for the Council Chamber. (See this issue.)

Morley.—Corporation. 8th May. Street lighting equipment. (See this issue.)

Pakistan.—Post and Telegraphs Department. 28th April. Communication receivers. (E.S.B. 8899/59. Ten/38482.)* 29th April. Linesman's testing telephone sets. (E.S.B. 8900/59. Ten/38464.)*

Salvador.—La Proveedurá General de la República, San Salvador. 21st April. 2,400 fluorescent tubes. (E.S.B. 8707/59. Ten/38461.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 24th April. Four 500 kVA and two 200 kVA transformers. (E.S.B. 9089/59. Ten/38486.)* 1st May. Boiler tubes and superheater elements. (E.S.B. 8616/59. Ten/38381.)* 400 V switchboards. (E.S.B. 8613/59. Ten/38368.)*

Pretoria Corporation. 19th May. Twenty-five 11 kV isolator units. (E.S.B. 8605/59. Ten/38422.)*

Union Tender and Supplies Board, Pretoria. 30th April. Copper jointing sleeves. (E.S.B. 8265/59. Ten/38354.)*

Stockport. — Corporation. 13th May. Horizontal submersible booster pumps. Engineer and manager, Water Department, Town Hall.

Thailand.—Thai Technical and Economic Committee, Bangkok. 1st May. Radio communications equipment. (E.S.B. 8683/59/I.C.A. Ten/38409.)*

Uruguay.—Administracion General de las Usinas Electricas y los Telefonos del Estado. 8th May. Radio valves and radio telephonic equipment. (E.S.B. 8530/59. Ten/38360.)* 12th May. Porcelain insulators. (E.S.B. 8524/59. Ten/38359.)* 13th May. Insulating tape. (E.S.B. 8525/59. Ten/38357.)* 14th May. 100 time controls for long distance calls. (E.S.B. 8526/59. Ten/38358.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Wigan.—Corporation. 23rd April. Electrical installations in dwellings. (See this issue.)

ORDERS PLACED

London.—L.C.C. Combined radio broadcast and sound relay system for Brixton Day College, Brixton Hill, S.W.2.—Easco Electrical (Holdings).

Manchester.—Regional Hospital Board. Recommended. Mains, electricity cables and switchgear, etc., at the Park Hospital, Davyhulme (£11,148).—W. H. Smith & Co.

Newcastle-on-Tyne.—City Council. Supply of 1,424 electric street lighting columns (£11,564).—Stewarts & Lloyds. 1,500 time switches for street lighting programme (£5,512).—Sangamo Weston.

Regional Hospital Board. Electrical installation in new ward block at Guisborough General Hospital (£8,295).—Doves.

Willesden.—Corporation. Recommended. Stanton columns and Atlas lanterns for street lighting on various roads (£27,241).—Atlas Lighting.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Alton.—Houses (77), Manor estate; Gregory Housing, Ltd., building contractors, Farncombe Road, Worthing.

Ascot.—Hostel for the aged, Larklands, London Road (£43,500); county architect, Wilton House, Parkside Road, Reading.

Ashington. — Three-storey ward block, Ashington Hospital; M. Gatoff, architect, 26, Mosley Street, Newcastle-on-Tyne.

Aycliffe (Co. Durham).—Factory additions for Tallent, Ltd.; Fennell & Baddiley, architects, Bridge End Chambers, Chester-le-Street.

Factory additions for R. W. Toothill, Ltd.; Cordingley & McIntyre, architects, Owengate, Durham City.

Barnard Castle.—Factory and offices for J. J. Robinson & Sons; J. Lawton, architect, Park Terrace.

Barnsley.—Crematorium, Ardsley; borough engineer, Town Hall.

Berkshire.—Hostel for the aged, Ascot (£43,500), and ambulance station and health clinics, Bracknell (£41,000); county architect, Wilton House, Parkside Road, Reading.

Bishop Auckland.—X-ray department at Auckland General Hospital; Gregory & Partners, consulting engineers, Pilgrim House, Pilgrim Street, Newcastle-on-Tyne.

Blaydon-on-Tyne.—Three-storey block of flats, Rowlands Gill (£38,000); N. Young, U.D.C. housing architect.

Blyth.—Proposed premises for Blyth Co-operative Society (£250,000); Waring & Netts, architects, 36, Jesmond Road, Newcastle-on-Tyne.

Bridgwater.—Houses (74), Sydenham estate; J. Standerwick & Sons, Ltd., Taunton Road.

Chelmsford.—Office block, Tindal Square; D. Walden, 136, New London Road.

Croston.—C.E. secondary school; Fred Thorpe & Whyman, architects, Church Lane, Oldham.

Ipswich.—Civic Centre; Vine & Vine, architects, Tudor Chambers, Station Road, London, N.22.

Jarrow.—Office block; Charles Lennig (Great Britain), Ltd., Tyneside Works, Jarrow.

London.—Nine-storey workshop block, Royal College of Art, Kensington; H. T. Cadbury-Brown, architect, 17, Clarges Street, W.1.

Luton.—Infants' school, Crawley Green; Robert Marriott, Ltd., builders, Higham Road, Rushden.

Manchester.—Moston College of Further Education; John Laing & Son, Ltd., Bunns Lane, London, N.W.7.

Margate.—Scheme for new town hall and municipal offices; borough engineer, 38, Grosvenor Place.

Middlesbrough.—Six-storey block of offices, Linthorpe Road, to house several Government offices; Ministry of Works, Leeds.

Newcastle (Staffs).—Flats (45), Stafford Avenue, Clayton; borough surveyor, Lancaster Buildings, High Street.

Newcastle-on-Tyne.—Additions to Heaton Grammar School (£71,000); R. Bowey & Son, builders, William Street, Gosforth.

North Riding.—Additions to Eston Grammar School (£70,000); C. Tennet, Ltd., builders, Church Road, Stockton-on-Tees.

Norwich.—Eleven-storey block of shops, showrooms and offices, Westlegate; W. S. Lusher & Sons, Ltd., School Lane, Sprowston.

Nottingham.—Office block on site near Trent Bridge, for the Trent River Board; John Dudding & Partners, Board's architects, 30, Clarendon Street, Nottingham.

Pontypool.—Police headquarters and court-room (£86,000); Sir Percy Thomas & Son, architects to C.C., 10, Cathedral Road, Cardiff.

Rhymney.—Houses (86); Council's architect, Manor House, Bank Square, Chepstow.

Scunthorpe.—Annexe to public baths (£35,000); borough surveyor, Municipal Offices, 34, High Street.

Shepperton.—Old people's home at Manygates Lane (£65,840); C. G. Stillman, county architect, 1, Queen Anne's Gate Buildings, London, S.W.1.

Shildon.—Factory additions for A. Morris, Ltd.; Cackett, Burns Dick & Mackellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Smethwick.—Houses at Uplands (119) and Stanhope Road (98); W. J. Whittall & Sons, Ltd., builders, Lancaster Street, Aston Cross, Birmingham, 4.

South Shields.—Factory additions for Prices Tailors, Ltd.; Williamson & Partners, architects, 7, St. Mary's Place, Newcastle-on-Tyne.

Sunderland.—R.C. junior school, Redcar Road; R. Burke, architect, 10, Lambton Road, Newcastle-on-Tyne.

Tipton.—Flats (48), Churchyard Road; Wates, Ltd., builders, 1258, London Road, S.W.16.

Watford.—Houses (123), Oxhey Place, South Oxhey; D. C. Denton Smith & Partners, architects, 40, Regent Street, Cambridge.

West Hartlepool.—Estate development providing for 1,000 houses; C. M. Yuill, Ltd., builders, Villiers Street, West Hartlepool.

Whickham (Co. Durham).—Office block, Swalwell, for C.A.S. (Industrial Developments), Ltd.; Llewelyn Smith & Waters, architects, 103, Old Brompton Road, London, S.W.1.

Whitstable.—Dwellings (46), Littlebourne and Hoath; H. V. Godfrey, architect, 63, Oxford Street.